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ROBERT TROUP PAINE
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Robert Troup Paine
to Harvard College

THE

ANATOMY

OF THE

HUMAN BODY.

COMPOSED

(On an Entire NEW PLAN,) in a Method very different from all Anatomical Writers.

Deſigned (chiefly) for the Uſe of Naval Practitioners, and by Way of Supplement to a Work,

ENTITLED,

THE MARINE SURGEON:

The whole, forming a Complete Repoſitory, for the SURGEONS of the ROYAL NAVY.

To which is ſubjoined,

Some Phyſiological Tracts, and a Copious Index.

By WILLIAM NORTHCOTE, Surgeon.

LONDON,
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TO

THE RIGHT HONOURABLE

GEORGE,

LORD EDGCUMBE,

LORD LIEUTENANT and CUSTOS ROTULORUM
Of the County of CORNWALL;

Rear Admiral of the BLUE SQUADRON,
Of His Majeſty's FLEET.

MY LORD,

WITH Pleaſure I now embrace this Opportunity of publicly declaring the Honor conferred on me, in the Permiſſion of your Lordſhip's Name to adorn this Work;

and am proud of thus acknowledging the great Reſpect with which

I am,

My Lord,

Your Lordship's

Moſt Obliged, and

Moſt Obedient

Humble Servant,

W. NORTHCOTE.

PREFACE.

THE following ſheets were compoſed ſome years ſince, merely for my own private uſe, and not originally intended for the preſs; but having lately publiſhed a work, entitled, The Marine Surgeon, or Surgery and Phyſic reduced to an exact Method for Sea-Practice; which has been favourably received by the public, the great encouragement that has met with, induces me now to offer this, by way of Supplement, that the whole may form a complete repoſitory for the naval ſurgeons, whoſe pockets may not be able to afford a large collection of authors, nor will their ſituation admit of it. The many uſeful and inſtructive books already extant, and the many able and judicious practitioners now living, particularly in this country, may be thought to render this treatiſe unneceſſary. In regard to the ſenior part, and majority of the profeſſion, I am convinced it is ſo; but as ſome, (eſpecially young Tyros in the art) may, without offence, be preſumed to be leſs informed, not having had the ſame opportunities of information, (particularly thoſe of the royal navy, for whoſe uſe theſe ſheets are principally deſigned, and who are in general, very deficient in this important branch of their profeſſion) I hope to be excuſed in attempting to convey inſtruction to thoſe who may ſtand in need of it, being always glad to receive it myſelf in any ſhape. The tedious, minute deſcriptions of anatomical authors in general, a few only excepted, tending rather to perplex than inſtruct a young ſtudent, I have, therefore, in the following treatiſe, endeavoured to avoid prolixity as much as poſſible; inſtruction being moſt impreſſive, when leaſt incumbered: yet, at the ſame time, I flatter myſelf, have ſufficiently explained all that is neceſſary to be known by the inexperienced practitioner, in order to his attaining a right method of treating diſeaſes ſo far as it depends on anatomy.

I have endeavoured alſo to render it not altogether uſeleſs to the elder and more experienced: to them it may ſupply the place of a remembrancer of what they were before more fully informed of; and, if it does not improve their knowledge, it will, at leaſt, refreſh their memories. As ſome of the ſubjects treated of are not a little obſcure, particularly, the minute ſtructure of the nerves, the nature of their fluid, and thoſe conditions on which depend their power of feeling, and communicating motion to the body, &c. it cannot be expected that they ſhould admit of ſo clear an explication, as matters that are leſs intricate; or, that I ſhould write any thing new on a ſubject which many learned and judicious authors have before ſo ingeniouſly and amply treated of. In a work of this kind, which is chiefly collected from other authors, diſcoveries muſt not be expected, though it is hoped, the reader will find ſome things both new and uſeful, or at leaſt related in a method very different from other anatomical writers. In compiling it, I have chiefly followed thoſe of the firſt rank among the moderns, viz. Albinus, Winſlow, Keil, Douglas, Heiſter, Monro, and Cheſelden; authors that have traced and explained the animal ſtructure with ſuch indefatigable pains and induſtry, as will derive honor both to themſelves and followers, and preſerve their reputation to future ages.

In the courſe of this work, what I have aimed at, is to be intelligibly plain: for, in writing, as in ſpeaking, an eaſy familiar perſpicuity is chiefly commendable.

As it is impoſſible to make any proficiency in the art of healing, without a competent knowledge of the human ſtructure, and animal oeconomy, I cannot help wondering at thoſe who take upon them to rectify the body when out of order, and at the ſame time know nothing of the curious contrivance of its parts; a circumſtance which renders them utterly incapable of judging of the diſeaſe, its proper remedy, or when to apply it, &c. The young artiſt is therefore deſired diligently and carefully to peruſe the following pages, whereby he may acquire the neceſſary information for his future practice.

Notwithſtanding all my care and attention in compoſing this work, I am ſenſible that not only many inaccuracies but miſtakes may have eſcaped me, which thoſe will moſt readily excuſe, who having themſelves made reſearches of this kind, are not unacquainted with the difficulties attending them. All others of experience in the profeſſion, I hope, will overlook with candor the defects which may be found. Yet, however imperfect theſe ſheets may be, I ſhall eſteem it my greateſt happineſs, ſhould it appear that I have done any thing, be it ever ſo trivial, which may tend to promote an art, in the advancement of which the good of mankind is ſo eſſentially concerned; and whatever may be the event of this mite thrown into the public treaſury, I hope it will be received as the honeſt endeavors of a ſincere well-wiſher, not only to his profeſſion, but to all mankind.

Cornwall,
June 12, 1769.

INTRODUCTION.

THE body formed, is the ſubject of ſurgery; and the accurate diſſection of it (or taking to pieces the ſeveral ſolid parts of a body, with a view to diſcover its ſtructure and uſes) is properly anatomy; wherein every ſurgeon ought to be well ſkilled, and exactly to know, and fully to underſtand, every part, and its proper uſe, in order to which a diligent and careful peruſal of the following ſheets will greatly contribute. Anatomy, ſubject of.

The uſe of anatomy is very great, and not confined to the bounds of medicine alone; for the philoſopher and the magiſtrate, the painter and the ſculptor are, in their reſpective employments, more or leſs qualified, in proportion to the progreſs they have made in this ſcience. The phyſician and ſurgeon, however, are thoſe to whom it is moſt immediately neceſſary, and who without a perfect knowledge of it, cannot do juſtice to the world in their profeſſions. What the needle is to the mariner, anatomy is to both theſe; and I may venture to ſay, that without its aſſiſtance they would be rather detrimental than beneficial to mankind. Its uſe.

The body is diſtinguiſhed by anatomiſts into venters and limbs. The venters are the more remarkable cavities of the body, in which, ſome principal part or bowel is contained, and are in number three, viz. the belly, breaſt, and head: the limbs are the arms and legs But, contrary to the common method of anatomiſts, I begin with the head, and then deſcribe the thorax, abdomen, and extremities. The names anatomiſts have given for the better underſtanding the ſub-contained parts are as follows, viz. the hollow on the middle of the thorax, under the breaſts, is called ſcrobiculus cordis; the middle of the abdomen for about three fingers breadth above and below the navel, is called regio umbilicalis; the middle part, above this, epigaſtrium; on each ſide of the epigaſtrium, under the cartilages of the lower ribs, hypochondrium; and from below, the regio umbilicalis, to the oſſa ilia and oſſa pubis, hypogaſtrium. The external parts, and common integuments, are as follows:

Cuticula, or ſcarf ſkin.

1. The cuticula, epidermis, or ſcarf ſkin, is a very fine, thin, ſmooth, inſenſible membrane, cloſely lying upon the cutis or true ſkin, of which it ſeems a part, and to which it adheres very firmly, being aſſiſted by the intervention of the corpus reticulare. The cuticula, in living ſubjects, ſeparates from the ſkin in burns, and by means of bliſters:

Its colour.

the colour of it in Europeans is white, but black in many other nations. It is compoſed of a multitude of very minute lamellæ, wherein are very numerous foraminula: the thickneſs of it is different in different parts of the body, but greateſt in the ſoles of the feet, and in the palms of the hands. The regeneration of the cuticle in living ſubjects, is eaſy.

All anatomiſts have failed in their attempts to find blood-veſſels in the cuticle; the abſence of which is probably the reaſon why it is deſtitute of ſenſation.

Its uſe.

Its uſe is to defend the cutis from injury, from dryneſs, and from pain, and finally to aſſiſt, and at the ſame time, to moderate the ſenſe of feeling.

Lewenhoeck and others ſay this membrane appears (through a good microſcope) ſcaly, and compute, that a grain of ſand of the hundredth part of an inch diameter, will cover two hundred of theſe ſcales, and that each ſcale has about five hundred pores; ſo that a grain of ſand (according to this account) will cover 125,000 pores through which we perſpire. Its pores.

In the ſcurvy, and ſcorbutic diſorders, the cuticula will ſometimes become ſcurfy, and full of little ulcers, which are apt to remain when the cauſe is removed; but a bliſter being applied, generally effects a cure. When ſcurfy, the cure.

2. The corpus reticulare, vel reticulum mucoſum, is a very fine membrane perforated in the manner of a net, with a multitude of foramina, and lies immediately under the cuticula. When the cuticle is ſeparated from the cutis (whether by art or accident) this membrane adheres firmly to it, and is ſcarcely to be ſeparated from it, ſeeming rather to be its inner ſuperficies than a diſtinct ſubſtance. Corpus reticulare membrane.

Its colour in Europeans is white, but in the negroes, and other black nations, it is black; in the tawny it is yellowiſh. The ſkin itſelf, in both, is white; for the whiteneſs, blackneſs, or yellowneſs depend altogether on the colour of this membrane, and the ſmall quantity of ſlimy matter or mucus it contains. Its colour.

The uſes of the corpus reticulare are to preſerve the ſtructure of the other parts of the integuments, and keep them in their determinate form and ſituation. Its uſes.

Its apertures give paſſage to the hairs, and let through the papillæ and excretory ducts of Its apertures.

of the ſkin: it retains theſe in a certain and determinate order, that they cannot be removed out of their places, and has ſome ſhare in preſerving the ſoftneſs of the papillæ, which renders them fit for the ſenſe of feeling.

The colour of this and the cuticula, is the only difference between Europeans and Africans or Indians, the fibres of the true ſkin, being white in all men; (as before obſerved) but the florid colour of the cheeks is owing to the blood in the minute veſſels of the ſkin, as that in the lips to the veſſels in the muſcular fleſh; for the cuticula being made of excrementitious matter, has no blood-veſſels, as above-mentioned.

Cutis, or true ſkin.

3. The cutis, or true ſkin, is a very compact, thick, ſtrong, and ſenſible membrane, covering the whole body; having nerves terminating ſo plentifully in all its ſuperficies, for the ſenſe of touching, that the fineſt pointed inſtrument can prick no where, without touching ſome of them.

The upper ſurface of this membrane adheres to the corpus reticulare and cuticula; and its under ſurface to the membrana adipoſa, or fat: in ſome places this connection is lax, in others it is very firm.

Its thickneſs.

The thickneſs of the cutis is very different in ſeveral parts of the body; the anterior portion of it in the abdomen, is not only thinner and more compact than the poſterior, but it has this likewiſe peculiar to it, that in the ſtate of corpulency, or pregnancy, it may be naturally increaſed very much in breadth, and ſometimes in a very extraordinary manner, without loſing any thing of its thickneſs, in proportion to what it gains in breadth.

Its furrows.

Its foramina.

The cutis has a multitude of ſulci or lines, which are common to it with the cuticle, and has foramina of two kinds in it. The larger foramina are thoſe of the mouth, noſe, ears, and the like; though, in effect, the cutis may rather be ſaid to be reflected, than perforated in thoſe parts; and the ſmaller called pores.

Its pores.

Theſe again are of different ſizes, ſome larger, ſome ſmaller, and ſerve to give paſſage to the hairs, and to the perſpiration. The pores are very large in the noſe, where the naked eye may ſee them.

Its ſtructure.

Its blood-veſſels, nerves, &c.

The ſenſe of feeling.

As to the ſubſtance and ſtructure of the cutis, it is compoſed of a multitude of tendinous fibres, ſingle, tenacious and interwoven in a wonderful manner, with a vaſt number of blood-veſſels and nerves, which conſtitute the pyramidal papillæ, and raiſe themſelves through the pores of the corpus reticulare. Theſe, when the cuticle is taken off, are very eaſily diſtinguiſhed in the palms of the hand and under the ſoles of the feet, and alſo at the ends of the fingers, where they conſtitute the primary organs of feeling. There are likewiſe the folliculi, or the receptacula cutanea, ſuppoſed by Heiſter to be the ſame with what are deſcribed by other anatomiſts under the name of ſebaceous glands, and cutaneous miliary glands, ſerving for the excretion of the perſpirable matter.

Its uſes.

The uſes of the ſkin are to defend the parts underneath from external accidents, to be the organ of feeling, to wrap the parts more firmly together, and to be an univerſal emunctory to the body, cleanſing the blood of its redundancies, by the means of ſweat and perſpiration; while theſe, at the ſame time, ſerve to prevent the flaccidity or dryneſs of the cutis itſelf.

Glandulæ ſebaceæ vel miliares.

4. Glandulæ ſebaceæ vel miliares are ſmall bodies like millet ſeeds, ſeated immediately under the ſkin in the axillas; and are ſaid to have been found under all other parts of the ſkin, where they have been looked for with microſcopes.

Perſpiration and ſweat.

Theſe glands are ſuppoſed to ſeparate ſweat; which fluid was thought to be only the materia perſpirabilis, flowing in a greater quantity, and condenſed, till Sanctorius aſſured us that it is not ſo, and that more of the materia perſpirabilis is ſeparated in equal times than of ſweat; of the former, he ſays, there are uſually fifty-two ounces a day (ſeparated) in Italy, (where his experiments were made) but of the latter, not near ſo much in the moſt profuſe ſweats; which ſeems to favour the opinion of the exiſtence of theſe glands. But whoever reads Mr. Hales's experiments, will find that what Sanctorius accounted for by an imaginary inſenſible perſpiration, different from that which in the greateſt degree produces ſweat, is really made by the lungs in reſpiration, in ten times a greater quantity than all the ordinary perſpiration thro' the cutis, and ſeems to be but the ſame kind of fluid diſcharged both ways; for whenever it is interrupted thro' the ſkin in cold weather, then the lungs are over charged, and a cough is produced.

Membrana adipoſa.

5. Membrana adipoſa is all that membrane immediately under the ſkin; it forms numerous interſtices or cells of different dimenſions (which contains the fat) by ſome, named cellulæ, and the ſubſtance made up of them, termed the cellular ſubſtance.

Its ſubſtance.

The thickneſs of this adipoſe membrane is not the ſame all over the body, as it depends on its number of laminæ; it is thickeſt on the abdomen and buttocks, and thinneſt neareſt the extremities: but where the muſcles adhere to the ſkin, and on the penis, little or none at all. It adheres very cloſely to the ſkin, running between the muſcles in general, and between their ſeveral fibres in particular, and communicating with the membrane which lines the inſide of the thorax and abdomen.

Its uſes.

It contributes to keep the inner parts warm and pliant; and by filling the interſtices of the muſcles, renders the ſurface of the body ſmooth.

Cauſes of an emphyſema

The cells of this membrane communicate throughout the whole body, in ſuch a manner, that from any one part, the whole may be filled with air, as is evident in beaſts, by the butchers blowing up their meat when newly killed, and in an emphyſema of the human body, ſometimes occaſioned by a broken rib, &c.

Sitution of an anaſarca, &c.

In theſe cells, the water is contained in an anaſarca, which from its weight, firſt fills the depending parts, and when theſe cells are very full, the water frequently paſſes from them into the abdomen, and after tapping, though the limbs were ever ſo full, they will almoſt empty themſelves in one night's time. This membrane is alſo the uſual ſeat of impoſthumations, carbuncles and boyles.

Pinguedo, or fat.

6. The pinguedo, or fat, is an oleaginous or butyraceous matter, ſecreted from the blood, and filling up the cavity of the cells of the membrana adipoſa; not ſecreted from the glandules, but from the little arteries of the adipoſe membrane. That this oleaginous matter has a circulatory motion, or an egreſs

into the veins, is very evident from the ſudden conſumption of it in many diſeaſes, and from its vaſt diminution by exerciſe and albour.

Its uſes. The uſes of the fat are, to ſerve as a kind of covering to the body, in order to defend it from cold and other injuries; to defend the more tender and ſenſible parts from being too ſtrongly vellicated by the ſalts; to preſerve in good order the flexion of the muſcles, of the cutis, and of the other parts, between, and about which it is placed; to facilitate the motions of ſome parts, as the eyes, jaws, &c. To fill up a number of interſticial ſpaces, and by that means to add greatly to the ſymmetry and beauty of the parts, as is evidently the caſe in the face, neck, &c. and to facilitate the diſtenſion of the parts, the ſpaces between which, it thus fills up. There is a manifeſt uſe of the fat about the vagina, the anus, the oſſa iſchii, and pudenda; which filling up many large ſpaces there, gives way greatly in the diſtenſion of thoſe parts in the excluſion of the fœtus, and even of the harder excrements. It alſo prevents the painful preſſure and attrition of the parts, particularly in the ſoles of the feet, the nates, and other the like parts, in all which, the fat is copiouſly diſpoſed, and ſerves in the place of a cuſhion for the muſcular fleſh to reſt upon. And finally, there is great reaſon to ſuppoſe, that when the body does not receive nouriſhment in the uſual way, the regreſs of the fat into the veins ſupplies that defect.

THE ANATOMY OF THE HUMAN BODY.

CHAP. I.

Of the Parts of the HUMAN BODY, in general.

SECT. I.

Conſtituent parts of the body.

THE animal body conſiſts of bones, cartilages, ligaments, muſcles, tendons, arteries, veins, nerves, lymphæducts, glands, excretory veſſels, membranes, and fibres; to which may be added the hair and nails.

Bones.

Bones are hard, brittle, inſenſible parts, deſigned to ſuſtain and give form to the whole body, &c.

Cartilages.

Cartilages approach much to the nature of the former, but are ſmooth and lubricous, flexible and elaſtic. Their uſe is to cover the ends of the bones that have motion, to prevent them from being damaged by a continual friction; and to contribute in a great meaſure, to the formation of ſeveral parts, as the larynx, noſe, ears, &c.

Ligaments. Ligaments are white, ſtrong membranes or fibrous, cloſe, compact ſubſtances, but more flexible than a cartilage. Their uſe is either to bind down the tendons, or to tie together ſuch bones as have motion; being not eaſily ruptured, torn, or ſtretched.

Muſcles. Muſcles are diſtinct portions of fleſh, and may be divided into the ſubſtance or belly of the muſcle, and the extremity or tendinous aponeurotic part; though the latter is ſometimes ſo very ſmall in ſome muſcles, as to be inviſible without the help of a microſcope. Both portions are covered by a particular membrane. By the contraction of the muſcles the ſeveral motions of the body are performed.

Tendons. Tendons are white, firm, tenacious parts, compoſed of the ſame fibres with the muſcles, continuous to, and uſually forming their extremities, but more cloſely connected, that they may take up leſs ſpace in a limb, and be inſerted in leſs room into a bone. When the fibres of which they are conſtituted expand themſelves into a membrane, it is called aponeuroſis.

Arteries. Arteries are conical tubes, which ariſe from the ventricles of the heart, and thence dividing into branches convey the blood to all parts of the body. They are compoſed of three membranes or coats, and have two reciprocal motions or pulſations, viz. a ſyſtole and a diaſtole, of which more hereafter.

Veins. Veins are tubes or veſſels which carry the blood from the ſeveral parts of the body to the heart. They are compoſed principally of a membranous, a vaſcular, and a muſcular tunic, but theſe are much thinner than in the arteries. They are a continuation of the extreme capillaries reflected back again towards the heart, which uniting their channels as they approach it, at laſt, form three large primary veins, viz. the vena cava, vena portæ, and the pulmonary vein.

Nerves. Nerves are bundles of whitiſh cylindrical fibres, ariſing from the medulla oblongata of the brain, and the medulla ſpinalis, from which they go out in pairs, like ſo many diſtinct trunks, and are afterwards divided into branches, ramifications and filaments, and terminate in all the ſenſitive parts of the body, being the immediate organs of ſenſation.

Lymphæducts. Lymphæducts are fine tranſparent tubes or veſſels, which carry lymph from all parts, eſpecially the glands, which they diſcharge into the larger veins, and into the vaſa lactea

Glands. Secretory glands are ſmall bodies formed by the intertexture of veſſels of every kind, covered with a membrane; generally compoſed of an artery, vein, lympatic, excretory duct, and nerve; the uſe of glands is to ſecrete fluids from the maſs of blood for divers purpoſes, ſuch as perfecting the lymph, &c.

Excretory veſſels. Excretory veſſels are either tubes from glands, to convey the ſecreted fluids to their reſpective places; or veſſels from the ſmall guts, to carry the chyle to the blood-veſſels; theſe laſt are called vaſa lactea.

Membranes. Membranes are a pliable texture of fibres, interwoven together, and expanded, to cover or line any other part. Thoſe which ſerve as integuments or covers of veſſels, are called tunics or coats; thoſe that cover the brain, meninges; the ſkull, pericranium; the bones in general, perioſteum; the thorax, pleura; and the membrane which includes the heart, pericardium.

The muſcles, too, are each encloſed in a peculiar membrane, as are the bowels, &c.

The uſe of the membranes is to cover and wrap up the parts, and ſtrengthen them; to ſave them from external injuries; to preſerve the natural heat; to join one part to another; to ſuſtain ſmall veſſels, and the nerves which run through their duplicatures; to ſtop the returning of the humors in their veſſels, as the valves ſtop the returning of the blood in the veins and heart; of the chyle in the thoracic duct, and of the lymph in the lymphatic veſſels.

Fibres. Fibres appear to be ſimple, thread-like bodies, which ſerve to form other parts. Hence ſome are hard, as the bony ones; and others ſoft, as the fleſhy parts.

Hair. Hair is compoſed of five or ſix oblong, ſlender, flexible filaments, incloſed in a tube, and tranſparent, growing out of the pores, and is either ſtrait or crooked, according to the rectitude or obliquity of the pores.

Nails. Nails are a kind of bony excreſcence, growing on the fingers and toes; their ſubſtance conſiſts of the cutaneous papillæ, elongated and indurated in that form.

SECT. II.

Of the BONES in General.

Bones in general. AS oſteology, or the exact knowledge of the bones, is the foundation of all anatomy, I ſhall begin with that ſubject in this anatomical expoſition of the human ſtructure.

The bones are in general, in reſpect to the body, what the timbers and beams are in a ſhip; they give ſtrength and ſhape to the frame, ſuſtain all its organs, and keep the machine in all ſituations proper for its functions, by means of their different conformation, ſtructure, and connexion. Uſe.

The ſubſtance of the bones conſiſts of lamellæ, or plates, lying one upon the other, joined together by tranverſe fibres, and as it were arch-wiſe; theſe fibres, when firſt formed, are very ſoft, but grow by degrees to the hardneſs of a cartilage, and afterwards of perfect bone. But the change is neither made in a very ſhort time, nor begun in all the parts of the ſame bone at once. Subſtance.

(Flat bones, that have their fibres directed on all ſides, begin to oſſify in, or near a middle point; but the cylindrical bones, and all others whoſe fibres are nearly parallel, begin about the middle of each fibre, and thence ſhoot forth to their extremities; not always in continued lines, but frequently beginning new oſſifications, which ſoon join the former; and by the continual addition of this oſſifying matter, the bones increaſe till their hardneſs reſiſts a farther extenſion; and their hardneſs always increaſing while they are growing, the increaſe of their growth becomes ſlower and ſlower, until they ceaſe to grow at all.) In ſeveral bones, the lamellæ, or plates, are diſpoſed diverſely. Thoſe which have a large cavity (as the cylindrical bones) are contiguous, and cloſely united; but in thoſe which have no great cavity, but are altogether ſpongious within, many of the internal laminæ are placed at ſome diſtance one from another in all their lengths, Oſſification how performed.

lengths, having between a cavernous ſubſtance, or ſmall bony cells; and ſome of thoſe cells are at both the extremities of all thoſe bones with large cavities alſo. In the bones, whoſe plates are contiguous, there are pores through and between the plates, beſides thoſe which are made for the paſſage of the blood-veſſels; and theſe are of two ſorts, the one penetrates the laminæ, and are tranſverſe, looking from the cavity to the external ſuperfices of the bone: the ſecond ſort are formed between the plates, which are longitudinal and ſtrait, tending from one end of the bone towards the other, and obſerving the courſe of the bony fibres.

The firſt kind are formed not only in the firſt internal laminæ, but in every one, even to the outermoſt; though the nearer they are to the cavity, the greater is the number of pores. The ſecond kind, viz. the longitudinal, are not to be obſerved, but by the help of a very good microſcope; (unleſs it be now and then, in ſome particular bones,) by theſe it is, that the medullary oil diffuſes itſelf, and is immediately beneficial to the plates: the other, viz. the tranſverſe, are but ſubordinate to theſe, and rather deſigned for the paſſage of the marrow into them, than for the immediate communication of it to the ſubſtance of the bone. On the ſurface of the bones, at the ends, are two kinds of prominences, the one termed apophyſis or proceſſus, and the other epiphyſis or appendage.

Apophyſis. The apophyſis is a continued part, or excreſcence of the bone, (as a branch is of a tree,) jutting out apparently above its plain ſuperficies, to make the better articulations, except where the bones are placed againſt other bones, and for the more commodious inſertion of the muſcles.

Epiphyſis. The epiphyſis is an additional bone growing to another by mere continuity, being generally more ſoft and porous than the other, though it moſtly degenerates into an apophyſis in adults.

Cavities, &c. Beſides the common large cavity, moſt bones have ſuperficial cavities, or ſinuſes, which are diſtinguiſhed into ſulci or furrows, and the holes for the nutritious and medullary veſſels to enter by, as all the bones are ſupplied, both within and without, with blood-veſſels and nerves. Dr. Havers divides the blood-veſſels of the bones into nutritious and medullary; the moſt conſiderable of the nutritious enter at the ends of the bones, viz. the artery at one end, and the veins at the other. If the bones had no cavities, they would, if they were ſtrait, ſuſtain the ſame weight; but being made hollow, their ſtrength to reſiſt breaking tranſverſely is encreaſed in proportion to their diameters, without encreaſing their weights; which is very evident in the wings and quills of birds: but the bones in the legs of all animals are more ſolid, being formed to ſupport weight.

Cheſelden ſays, the bones are not diſpoſed into viſible plates or lamellæ, ſtratum ſuper ſtratum, as before-mentioned, and as many have painted them; but I think, with a good microſcope they ſeem to have that appearance, though it makes no material difference to the enquirer, whether they have or not; therefore I ſhall enter into no diſpute on that ſubject.

Medulla, or marrow.

The medulla, or marrow, contained in the bones, conſiſts (beſides the blood-veſſels) of an inveſting membrane, in which are included membranaceous lobules, and bags that fill up the cells of the bones; and in theſe bags are veſiculæ, or glandulous bladders, very like the veſicular ſubſtance of the lungs.

The marrow, being more or leſs diſtributed all over the bones, and tranſuding through their plates and fibres, makes them tougher, and leſs brittle; but does not nouriſh them, as was originally believed. The large middle cavity of all cylindrical bones contains an oily marrow; but the great number of leſſer cells towards their extremities, contain a bloody marrow, or rather a kind of red, fatty, medullary juice, which laſt is found in all ſpongy heads and cells of bones. The marrow in young bones is more red and bloody than in old ones, as the oily marrow would otherwiſe render their fibres too ſoft.

Medullary veſſels.

The medullary veſſels, found running here and there, through their proper canals, penetrate into the inner cavity of the bones, and ſecrete the medullary part from the blood; the blood being afterwards returned by the veins. The nerves are diſtributed to the ſame places, for the ſake of ſenſe and motion. Theſe veſſels enter the bones obliquely, that they may not weaken them by dividing too many fibres in the ſame place.

Perioſteum.

All the bones in the body (except a part of the teeth, and the places in bones where the muſcles are inſerted,) are immediately ſurrounded in every part, (both the internal and external ſurfaces, with an exquiſite ſenſible, nervous, vaſcular membrane, called perioſteum, but in the ſkull, pericranium. It is divided into the external and internal, or under and upper. The under is derived from the dura mater, the upper from the membranes of the muſcles that lie upon it; which fibres lie contiguous, but are not interwoven with each other. The under fibres run all parallel from one end of the bone to the other, and are continued from one bone to another, by means of the ligaments that join them together in their articulations, upon which they paſs: the upper hold the ſame courſe with the fibres of the muſcle from whence they are derived, ſometimes ſtrait, ſometimes oblique, ſometimes tranſverſe; and when they run ſo far as to make up their part of the perioſteum, they are inſerted into the bone, and are ſucceeded by others, from ſome other muſcles. The inner ſuperficies of the perioſteum ſticks as cloſe to the bone as if it were glued to it; and beſides, the perioſteum has little fibrillæ, or threads, continued from it, that enter into the ſubſtance of the bone, which give them, probably, ſome internal ſenſe.

The perioſteum conſtitutes the firſt rudiments of the bones in a fœtus in utero; and ſerves alſo for the muſcles to ſlide eaſy upon, and to hinder them from being lacerated by the roughneſs and hardneſs of the bones.

It is every where full of ſmall blood-veſſels, which enter the bones for their nouriſhment; but the internal ſubſtance of the larger bones is nouriſhed by the veſſels which enter obliquely through their middles. It is alſo the organ of ſecretion for the bony matter, as the membrana adipoſa is for the fat. The ſenſibility of the bones, is wholly owing to this membrane, (perioſteum) for when diveſted of this, they may be ſawed, cut, or burnt, without pain. It gives the determination and figure to bones, as is evident from this, that when it is wounded, exoſtoſes, tophi, and caries, ariſe in the part. It is of different thickneſs in different parts, but in general, the internal is vaſtly thinner than the external. It is generally ſaid to ariſe from the dura mater of the brain, but Heiſter is of a different opinion, as the perioſteum is evidently formed at the ſame time with the dura mater in the fœtus.

The bones are connected together various ways, according to the various purpoſes they are to ſerve, ſome being intended for motion, others for reſt, and the ſupport of the incumbent parts only.

The following table of oſteology ſhews, at one view, the ſeveral bones of the human body, &c. (the ſeſamoidal bones excepted) and whereto they belong.

A TABLE of OSTEOLOGY.

				Nº
The Bones of the Head, are	The Bones of the Cranium or Skull	Oſ.	Parietalia	2
			Æthmoides	1
			Frontis	1
			Occipitis	1
			Sphenoides	1
			Tempora	2
	The Bones of the Fauces and Face	Oſ.	Malarum	2
			Maxillaria	2
			Naſi	2
			Plana	2
			Palati	2
			Vomer	1
			Ungues	2
	The Bone of the Lower Jaw	Os	Maxilla Inferior	1
	Dentes, the Teeth	Dent.	Canini	4
			Inciſores	8
			Molares	20
	The Bones of the Os Hyoides of the Tongue.	Oſ.	Hyoides	5
	The Bones of the Internal Ear	Oſ.	Incus	2
			Malleus	2
			Orbiculare	2
			Stapes	2
				67

				Nº
The Bones of the Trunk, are	The Spine	Vertebræ	Neck	7
			Back	12
			Loins	5
		Os Sacrum and Coccyx		2
	The Thorax	Sternum		3
		Ribs		24
	The Pubes	Oſſa Inominata	Os Ilium	1
			Iſchium	1
			Pubis	1

The Bones of the Upper Extremities.	The Shoulder		Clavicula	2
			Scapula	2
	The Arm		Os Humeri	2
	The Fore-Arm		Ulna	2
			Radius	2
	The Hand	Carpus	Oſ. Naviculare	2
			Lunare	2
			Cuneiforme	2
			Magnum	2
			Orbiculare	2
			Trapezium	2
			Trapezoides	2
			Unciforme	2
		Metacarpus		8
		Phalanges		30
The Bones of the Lower Extremities.	The Thigh		Oſ. Femoris	2
	The Leg		Oſ. Patella	2
			Tibia	2
			Fibula	2
	The Foot	Tarſus	Oſ. Calcis	2
			Aſtragalus	2
			Cuboides	2
			Cuneiformia	6
			Naviculare	2
		Metatarſus		10
		Phalanges		28
			In all	247

N. B. By the above account, it appears, that there are in all 247 bones in the human body, (excluſive of the ſeſamoidal bones, whoſe number is uncertain,) but the number is various in various ſubjects, though commonly, as here mentioned: yet ſome ſay 300, or 307; others 318; but late writers fix it at 247, 249, or at moſt 250.

SECT. III.

Of the CARTILAGES, LIGAMENTS, and MUCILAGINOUS GLANDS of the JOINTS in General.

A Cartilage is a whitiſh, or pearl-coloured ſubſtance, which covers the extremities of bones joined together by moveable articulations: for cartilages being ſmoother and ſofter than bone, they render the motions more eaſy, and prevent the bones wearing each other in their actions; but with age they ſometimes grow ſo hard as to become perfect bony. Cartilage.

Carolus Stephanus (in his Anatomy) gives the following ſhort definition of a cartilage. "A Cartilage, he obſerves, is a part of the body, which truly deſerves the name of ſimple, or ſimilar. It is harder than all the other parts, but ſofter than the bones, white, ſmooth, poliſhed, and pliable or flexible. The coheſion of its parts is different in different cartilages; and no ſenſible cavity, cell, or pore, appears in any part of its ſubſtance, except very ſmall paſſages for the blood-veſſels, &c." I here ſpeak only of cartilages that belong to the bones; thoſe which have no relation to them, are deſcribed hereafter in their proper places, throughout the courſe of this work. The cartilages united to bones are of four kinds. Some cover both ſides of the moveable articulations, and are very ſmooth; ſome unite the bones to each other, either ſo firmly as to allow no ſenſible motion, or elſe in ſuch a manner as to allow of different motions. The firſt grow eaſily hard, the others appear in ſome meaſure viſcid, and retain their flexibility. Some increaſe the ſize and extent of bones; of theſe again ſome are articulated with other bones, others ſerve only for borders; ſome, in fine, have a ſingular form, as thoſe of the ears, and moſt of thoſe of the noſe; in which laſt, their elaſticity appears moſt ſenſibly. The cartilages not immediately joined to bones, are, for the moſt part, placed in the moveable joints, and may likewiſe be ſubdivided into ſeveral kinds. Some lie altogether looſe, being joined neither to the articulated bones, nor to the cartilages which cover them, but ſlide freely between them in different directions; ſome are partly joined to other cartilages, and partly ſlide between the cartilaginous extremities of the articulated bones.

Ligaments. A ligament is a white, fibrous, cloſe, compact ſubſtance, more flexible than a cartilage, not eaſily ruptured or torn, and which does not yield, or at leaſt but very little, when pulled. Ligaments form either narrow cords, broad bands, or thin webs; and theſe ſerve to bind, contain, limit, and defend the other parts, both hard and ſoft. I ſhall here ſpeak only of thoſe which belong to bones or cartilages alone; ſome of theſe belong wholly to the articulations or moveable bones, and others, have nothing to do with the articulations: thoſe which are common to the ſoft parts, or both ſoft and hard parts, will be mentioned in their proper place, and are, therefore, now deſignedly omitted. The ligaments which belong particularly to the moveable articulations, and may therefore be called articular ligaments, are of ſeveral kinds. Some are deſigned only to fix and ſtrengthen the joints, and to ſecure the bones in their different motions, from parting from each other, as happens in luxations. Theſe ligaments are like ropes, more or leſs flat, or like bands, ſometimes narrow, and ſometimes of a conſiderable breadth; and though ſome of them are thin, they are all very ſtrong, and yield but little. Some contain a very fluid, mucilaginous liquor, commonly called ſynovia, which continually moiſtens the articulations. As the liquor is contained in capſulæ or bags, theſe may very well be named capſular ligaments; they lie within the former ſort, being cloſely united to their internal ſurface, and are to be met with in all the moveable joints. Some perform both the former offices, that of a band to keep the bones together, and of a capſula to hold the mucilage. Theſe ſurround the orbicular articulations, as that of the os humeri with the ſcapula, and of the os femoris with the os inominatum, &c. All the parts of theſe ligaments are not of equal thickneſs, ſo that they appear to be made up of two kinds of ligaments inſeparably united or glued together; one capſular, which ſurrounds the whole articulation, and ſeveral true ligaments extended at different diſtances over the other, and cloſely united to it. The membranous vagina belonging to the channel or groove, in the upper part of the os humeri, will be mentioned in its proper place. Some ligaments are hid by the joints themſelves, and by the capſular ligaments, as that belonging to the head of the os femoris, called improperly ligamentum teres, and the crucial ligaments of the tibia. The ligaments which ſerve to connect cartilages with bones, might be reckoned another ſpecies of articular ligaments.

The ligaments fixed to bones without any relation to the articulations, are of two kinds. Some of them are looſe, and ſerve only to ſet bounds to the motions of bones; ſome are tight, and ſtretched either between the parts of the ſame bone, or between ſeveral bones united together without motion. The ligaments that are fixed to bones or cartilages, and are likewiſe of uſe to other parts, are alſo of two kinds. Some of them are fixed to bones or cartilages only, and ſome are likewiſe fixed to other parts, or other parts are fixed to them; thoſe of the firſt kind ſerve chiefly to incloſe, check, limit, and ſtrengthen the muſcles and tendons, and ſometimes to change their directions; among theſe are the annular and ſemi-annular ligaments, &c. thoſe of the other kind comprehend the ligaments fixed to other parts as well as to bones, and theſe again are of two ſorts. Some of them are fixed to one or more bones, with different degrees of tenſion; and ſerve on each ſide for the inſertion of muſcles, ſupplying in that reſpect, the place of bones; ſome ligaments are almoſt cartilaginous, and have a particular elaſticity, by which they are capable of being drawn out by a ſufficient force, and of contracting again when left to themſelves. This elaſticity differs from that of cartilages, which laſt is hardly perceivable, but by compreſſing or bending them to a certain degree. It differs likewiſe from that of the other ligaments, in that it is not only very conſiderable in living bodies, but remains ſuch after death. It is generally agreed, that the ligaments are inſenſible; and the reaſon aſſigned is, that they would elſe be injured by ordinary motions: but they are much better contrived, ſeeing none of them, not even thoſe which lie between the vertebræ, are ſubject to attrition; but the other, experience ſhews, are capable of very acute pains, nothing being more painful than collections of matter within theſe parts, or ſharp medicines applied to them when laid bare.

Mucilaginous glands of the joints.

There are ſmall glands which furniſh every joint, where the bones are furniſhed with a cartilage for a ſliding motion, with a mucilaginous matter, for lubricating the ends of the bones, that they may move eaſily upon one another; and that there may be no waſte of this neceſſary fluid, it is contained in the inveſting ligaments; which for this very reaſon are no where divided, except to communicate with the ligaments of the tendons. Theſe glands are generally ſeated in a little fat, near the inſertion of the ligaments, that they may be compreſſed by them when the joints are in motion, which is a proper time to have their fluid preſſed out. The moſt conſiderable parcel of theſe glands with their fat, are ſeen in the joint of the knee, and the largeſt gland of this ſort, is found in the ſinus, at the bottom of the acetabulum of the os inominatum, and is compreſſed by the ligamentum teres.

Diſeaſes of the joints; their cauſe.

The diſeaſes of the joints either happen from ulcers in the mucilaginous glands, which pouring out matter that cannot be diſcharged, foul the ends of the bones, or elſe from ſwellings in the ends of the reſpective bones. Either of theſe, in time, create exceſſive pain, which appears to be chiefly in the ligaments of the joints, notwithſtanding what has been ſaid of the inſenſibility of theſe parts. When a joint is much ſwelled and painful, without external inflammation, it is vulgarly called a white-ſwelling, and more properly than a ſpina ventoſa. It is ſometimes in the beginning cured by evacuations, but when the limb waſtes below the ſwelling, and the fingers or toes of the limb grow thinner at their joints, and loſe their ſhape, the caſe is abſolutely irrecoverable. Sometimes the ends of the bones erode, then join together, and form an anchyloſis, which, though a ſevere diſeaſe of itſelf, yet proves often the remedy of a much worſe. In like manner, the bones of the hands and feet, when they are ulcerated, ſometimes unite, and are thus preſerved from total ruin. But there is one caſe of a white-ſwelling that is amazing, where the pain is ſo great that we are forced to take off the limb, and yet neither find upon diſſection the ligaments or glands diſeaſed, matter in the joint, the bones carious, nor any diſeaſed appearance, except that the ends of the bones are a little larger and ſofter.

SECT. IV.

Of the MUSCLES in general.

Muſcle deſcribed.

THE immediate organ of voluntary motion is a muſcle, which is ſoft and red, and more properly called fleſh than that which is glandular or parenchymous. It is an organic part compounded of fibres, tendons, nerves, membranes, veins, and arteries. It hath one or more tendons at its beginning and end: its end is in that place

Uſes.

where the tendons are greateſt and moſt in number; its head and beginning, where the nerve is inſerted; the belly of it is its middle or fleſhy part. The uſe of a muſcle is to promote voluntary motion, and where the part to be moved is great or large, and requires ſtronger force, nature hath appointed a ligament, the more firmly to faſten the muſcle to the bone, and the apophyſis and epiphyſis of the bones, to facilitate the motion by raiſing the head. It hath been unanimouſly taught, that the ſoul effects motion in the muſcle at pleaſure, by tranſmitting from the brain by the nerves, animal ſpirits, by whoſe copious influx, the muſcles to be moved are in an inſtant inflated and ſo contracted, that they pull and move the member to which the tail is faſtened. For this end, nature hath inſerted a nerve or more into each muſcle, ſo that the fleſh and nerves are the principal conſtituents of a muſcle; and, indeed, ſome nerves ſeem to have their bodies made up of nothing elſe, than an intertexture of nervous and fleſhy fibres, as the muſcles of the forehead, temples, bladder, anus, and all ſphincters; hence, in reſpect of ſubſtance, ſome muſcles are moſtly carnous, as all the ſphincters and muſcles of the tongue; others, moſtly nervous and membranous, as the faſcia lata tibiam adducens, quadratus vel diſtortor oris, by Galen named platyſma myoides, being firſt contracted involuntarily in the ſpaſmus Cynicus.

Subſtance and Difference.

Aponeuroſis.

If the tail, moveable point, or tendon of a muſcle be broad and membranous, it is called an aponeuroſis: in many of the muſcles both the extremities are moveable; in theſe, that part, which of the two is leaſt moveable, is always called the origin, or head, and the more moveable part the tail. This however, cannot be done univerſally; ſince there are caſes in which that extremity of a muſcle, which was before the tail or moveable point, becomes the head or fixed point; and vice verſâ, as in the ſerati antici, and ſome of the muſcles of the abdomen, &c.

Membrane.

Each muſcle, as far as it is diſtinct, and is moved againſt any part, is covered or incloſed in a ſmooth membrane, to make the friction eaſy; but where it is externally tendinous, thoſe tendons are often ſmooth enough to make ſuch a covering needleſs. Beſides this membrane, there is another, known by the name of faſcia tendinoſa, which deſerves to be particularly conſidered; the ſtrong one on the outſide of the thigh, which belongs to the faſcialis and gluteus muſcles, is of great uſe in raiſing the gluteus farther from the centre of motion of the joint it moves, to increaſe its force: in like manner the faſcia, detached from the tendon of the biceps cubiti, alters its direction for the ſame purpoſe; but thoſe on the outſide of the tibia and cubit, &c. are only flat tendons from which the fibres of the muſcles ariſe as from the bones.

There are alſo in many places ſuch tendons between the muſcles, from which each muſcle ariſes in like manner, for the bones themſelves are not ſufficient to give origin to half the fibres of the muſcles that belong to them; beſides, if all the fibres had riſe from the bones, they muſt have been liable to compreſs one another very inconveniently.

Dimenſions.

In regard to quantity, which reſpects all dimenſions, as longitude, latitude, and profundity,

fundity, ſome are long, as the rectus abdominis, dorſi longiſſimus, ſartorius; others ſhort, as the pyramidalis, in the bottom of the belly; others broad, as the oblique and tranſverſe muſcles of the abdomen, latiſſimus dorſi; others narrow, as thoſe of the fingers and toes; others thick and bulky, as the two vaſti of the femur, and glutæi of the buttocks, &c. others thin and ſlender, as the gracilis bending the leg.

Figure. In reſpect of figure, ſome are triangular, ſome ſquare, ſome pentagonal, ſome round, ſome in other ſhapes, as is exemplified in the deltoides, rhomboides, ſcalenus, trapezius, &c. Some are tranſverſe, ſome above, ſome below, ſome before, ſome behind, ſome on the right ſide, ſome on the left; where, in general, it may be obſerved, that all oblique muſcles ſerve for oblique motions; all right or ſtrait muſcles, to direct flexion or extenſion; all internal to flexion, and all external to extenſion.

Origin. In reſpect of their origination, ſome ariſe from bones, and that either from the heads of them, as moſt of the great muſcles do, or a little below; ſome only from one bone, ſome from two or three, others from cartilages, as the muſcles proper to the larynx; others from the membrane ſurrounding the tendon, as the muſculi vermiculares, or lumbricalis, in the hands and feet; others again from other parts, as the ſphincters. Inſertion. In reſpect of their inſertion, ſome are inſerted into bones, ſome into cartilages, as the muſcles of the larynx; others into a membrane, as the muſcles moving the eye; others into the ſkin, as the muſcles of the lips; ſome ariſing from divers parts are inſerted into one; and, on the contrary, others ſingle in their origin, are yet divided in their terminations: not that all muſcles formed for motions, either ſtrong or continual, do all end in tendons greater or leſs; and in reſpect of motion of the bones the tendons are inſerted, not into the end of the ſame bone from which they ariſe, but near the head of another which they are to move; likewiſe to corroborate and facilitate the motion of the eye, there are tendons beſtowed on its muſcles.

Sorts of muſcles.

The muſcles are of two ſorts, viz. ſimple or rectilineal, and compound or penniform. The ſimple have their fibres almoſt parallel in the ſame, or near the ſame direction with the axis of the muſcle; and the compound have their fibres joined in an oblique direction to a tendon paſſing in or near the axis, or on their outſide.

Names.

Some muſcles borrow their names from the part in which they are ſeated, as the temporal muſcles, ſpinal muſcles, &c.

Diverſity of actions.

In reſpect of the diverſity of their actions, they admit of a triple difference, viz. Some are confederates, concurring to one and the ſame motion, either of flexion or extenſion, one being placed on the right, the other on the left ſide of the member; others are antagoniſts performing motion contrary to each other. To every flexor is oppoſed an extenſor; to every adductor an abductor; to every elevator a depreſſor, excepting only in the ſphincters, cremaſters, and œſophagus.

Rectilineal or ſimple muſcles.

The ſimple, or rectilineal muſcles, if their origins and inſertions are in little compaſs, are never of any conſiderable thickneſs, unleſs they are very long, becauſe the outward fibres would compreſs the inner ones, and make them almoſt uſeleſs; and therefore every rectilineal muſcle, whoſe inner fibres are compreſſed by the outer, have their inner fibres longer than the external, that they may be capable of equal contraction.

Penniform or compound muſcles.

The compound, or penniform muſcles, though they are in a manner free from the inconvenience of one fibre compreſſing another, and though by the obliquity of their fibres, nothing is abated of their moment; yet the fibres of theſe muſcles becoming more and more oblique as they contract, their ſtrength decreaſes, and their velocity increaſes, which makes them leſs uniform in their actions than the rectilineal muſcles; wherefore it ſeems, that nature never uſes a penniform muſcle where a rectilineal one can be uſed; and the caſes in which a rectilineal muſcle cannot be uſed, are where the ſhape of a muſcle is ſuch, as that the inward fibres would be too much compreſſed, or where rectilineal fibres could not have a lever to act with ſuitable to their quantity of contraction, which is the caſe of all the long muſcles of the fingers and toes. Every muſcle muſt be inſerted, or paſs over the centre of motion of the joint it moves, at a diſtance ſuitable to its quantity of contraction, and the quantity of motion in the joint moved; for if it was inſerted too near, the motion of the joint would be performed before the muſcle is fully contracted; if too far off, the muſcle would have done contracting before the whole motion of the joint is made.

Though the quickneſs and quantity of motion in a muſcle will be (cæteris paribus) as the length of its fibres; yet two muſcles of equal magnitude, one long, and the other ſhort, will both move the ſame weight, with the ſame velocity, when applied to a bone; becauſe the levers they act with muſt be as their lengths; and therefore the penniform, and ſhort thick muſcles, are never applied to a bone for the ſake of ſtrength, nor long fibred muſcles for quickneſs; for whatever is gained by the form of the muſcle, whether ſtrength or quickneſs, muſt be loſt by their inſertions into the bone, or elſe the muſcles muſt not act all they can, or the bones have leſs motion than they ought.

Force of muſcles how to calculate.

In order to calculate the force of any muſcle, we are to conſider the bones as levers; and then the power or force of the muſcle will be always to the reſiſtance or weight it is capable of raiſing, as the greater diſtance of the weight from the centre of motion is to the leſſer diſtance of the power. What appears moſt wonderful is, the force of the muſcles that move the lower jaw, which, when taken altogether, do not in a man exceed the weight of one pound, and yet exert a force equal to five hundred and thirty-four pounds; and in maſtiff dogs, wolves, bears, lions, &c. their force is vaſtly ſuperior, ſo as to break large bones, as they practiſe daily in their feeding. In the limbs, ſeveral muſcles paſs over two joints, both of which are liable to move at once, with force proportionable to the levers they act with upon each joint; but either joint being fixt by an antagoniſt muſcle, the whole force of ſuch muſcles will be exerted upon the other joint, which, in that caſe, may be moved with a velocity equal to what is in both joints, when theſe muſcles act upon both at once.

The uſe and action of any muſcle (that has not the neceſſary aſſiſtance of any other muſcle) in moving a joint, we may always know in any ſituation, and with what force it acts, cæteris paribus, by dropping a line, from the centre of motion of the joint it moves, perpendicular to the axis of the muſcle; but in a joint which admits only of flexion and extenſion, this line muſt alſo be perpendicular to the axis of motion in that joint; the action of the muſcles will alſo be in the direction of that perpendicular line, and the force with which it acts in any ſituation will be, cæteris paribus, as the length of that perpendicular line. The motions of the far greater part of the muſcles are voluntary, or dependent on our will; thoſe of a few others involuntary. Thoſe muſcles which perform the voluntary motions, receive nerves from the brain or ſpinal marrow; thoſe which perform their motions involuntarily, have their nerves from the cerebellum; and thoſe whoſe motion is partly voluntary and partly involuntary, have theirs in part from the brain, and in part from the cerebellum. And as a muſcle can no longer act when its nerve is either cut aſunder, or tied up, ſo nearly the ſame abſolute dependence it has on its artery; for from the experiments of Steno and others, on living animals, it appears, that on cutting, or tying up the artery, the muſcle in the ſame manner, ſome hours after, loſes its whole power of action, as if the nerve had been cut or tied up.

The Reduction of the Muſcles, each to its proper Uſe and Part.

- The Forehead
  - is lifted up, by the Occipito-frontalis.
  - is depreſt, by the Frontalis.
- The Eye-brows are drawn together, by Corrugator Supercilii.
- Eye-Lids
  - the Upper
    - are lifted up, by the Elevator Palpebræ Superioris.
    - are depreſt, } by Orbicularis Palpebrarum.
  - the Under — are lifted up, } by Orbicularis Palpebrarum.
- The Eyes are moved
  - Rightly -
    - Upwards, by Elevator Oculi.
    - Downwards, by Depreſſor Oculi.
    - Inwards, (towards the Noſe) by Adductor Oculi.
    - Outwards, by Abductor Oculi.
  - Obliquely — Upward
    - and Forward, by Obliquus Inferior Oculi.
    - and Inward, by Obliquus Superior Oculi.
- The Noſe is
  - Dilated by Elevator Alæ Naſi.
  - Contracted by
    - Compreſſor Narium.
    - Depreſſor Alæ Naſi.
- The Lips are
  - drawn upward, by the Elevators.
  - drawn downward, by the Depreſſors.
  - drawn laterally, by Zygomaticus and Buccinator.
  - purſed up, by Sphincter Oris.
- The Ears are moved
  - Externally
    - Upward, by Elevator Auriculæ.
    - Forward, by Anterior Auriculæ.
    - Backward, by Retractor Auriculæ.
  - Internally, by Muſculi Auriculæ Internæ.

The Cheeks are
- drawn Inwards and Downwards, by Platyſma Myoides.
- drawn Outwards and Upwards, by Buccinator.

The Chin is — drawn up, by Elevator Menti.

The Under Jaw is drawn
- Downwards, by Biventer.
- Upwards, by Temporalis.
- Laterally, by Maſſeter.
- Forward, by Pterygoideus Externus.
- Backward, by ——— Internus.

The Tongue is moved
- in Conſtriction, by Lingualis.
- in Dilatation, by Lingua.
- Forward, by Genioglоſſus.
- Backward, by Baſioglоſſus.
- Laterally, by Ceratoglоſſus.
- Upward, by Styloglоſſus.

The Os Hyoides is moved
- Right
  - Upward, by Geniohyoideus.
  - Downward, by Sternohyoideus.
- Obliquely
  - Upward, by Stylohyoideus.
  - Downward, by Coracochyoideus.
  - Sideways, by Mylohyoideus.

The Palate is moved, by the Muſculi Palati.

The Uvula
- is pulled up while we breathe through the mouth by Pterygoſtaphylinus Internus.
- is pulled down when we breathe through the Noſe, by Gloſſo Staphylinus.

The Fauces are
- Dilated by—Pterygopharingæus.
- Conſtricted by—Muſculus Oeſophagus.

The Larynx is
- Dilated / Contracted, when Thyroides is
  - Extended, by Sternothyroideus.
  - Bended, by Hyothyroideus.
- Shut— / Opened-- while Arytænoides—is
  - Bent
    - Rightly, by Thyroarytænoideus.
    - Obliquely, Laterally, by Arytænoideus.
  - Extended
    - Rightly, by Cricoarytænoideus Poſticus.
    - Obliquely, Laterally, by Cricoarytænoideus Lateralis.
- Bended by Maſtoideus
  - Rightly, if both move.
  - Obliquely, Laterally, if but one move.

The Glottis, is covered by — the Muſcles of the Epiglottis, which are
- Arytænoepiglotticus.
- Hyoepiglotticus.
- Thyroepiglotticus.

The Head is moved
- Forward, by
  - Rectus Internus Major.
  - ——— ——— Minor.
- Backward, by
  - Rectus Major Poſticus.
  - ——— Minor Poſticus.
- Laterally, by — Rectus Lateralis.

The Head is turned about, by
- Obliquus Inferior.
- ——— Superior.

The Head and Neck is
- Extended
  - Rightly, by
    - Biventer Cervicalis.
    - Complexus.
  - Laterally, by Splenius Capitis.
- Bended, by Maſtoideus.
- Moved Laterally, by Trachelo-Maſtoideus.

The Neck is moved
- Backward, by
  - Interſpinales Cervicis.
  - Spinalis Cervicis.
- Forward, by—Longus Colli.
- Laterally, by Intertranſverſales Cervicis.
- Obliquely Backward, by Tranſverſalis Cervicis.

The Thorax is moved

- Primarily, by its proper Muſcles,
  - which Dilated in Breathing
    - Freely, the Diaphragma alone is contracted.
    - Coactively, the Diaphragma et Intercoſtales Externi.
  - which conſtringed in Breathing
    - Freely, the Diaphragma alone is relaxed.
    - Coactively, the Diaphragma et Intercoſtales Interni et Triangularis Sterni.
  - which extend as Extenſor Dorſi et Lumborum
    - Interſpinalis Dorſi,
    - Intertranſverſarii Dorſi,
    - Longiſſimus Dorſi,
    - Multifidus Spinæ,
    - Sacer et Sacrolumbalis,
    - Semiſpinalis Dorſi,
    - Spinalis Dorſi,
    - Tranſverſalis,
      - which are retained in Loco, by
        - Scalenus.
        - Serratus Inferior } Poſticus.
        - Serratus Superior } Poſticus.
  - which bend as
    - Recti - - } Abdominis.
    - Obliqui Aſcendentes } Abdominis.
  - turned about by Tranverſalis Abdominis.
- Secondarily, by the Lumbal Muſcles,
  - Bent by
    - Quadratus Lumborum.
    - Intertranſverſarii Lumborum.
    - Pſoas Parvus.
  - Extended by—Sacer, &c.
- Laterally, by—Obliqui Aſcendentes et Deſcendentes.
- Forward, by—Recti Abdominis.
- Downward, by—Pyramidalis, &c.

- The Loins are
  - Bent by
    - Intertranſverſales Lumborum.
    - Pſoas Parvus.
    - Quadratus Lumborum.
  - Extended, by,—Extenſor Dorſi et Lumborum.

The Stones are ſuſpended, by Cremaſteres.

- The Penis is
  - Erected, by Erectores Penis.
  - Accelerated, by Accelatores Urinæ.

The Urethra is Dilated, by Tranverſalis Penis.

The Clitoris is erected, by Erectores Clitoridis.

The Vagina is conſtringed, by Sphincter Vaginæ.

- The Bladder
  - Retains, by Sphincter Veſicæ.
  - Excretes by
    - Detruſor Urinæ.
    - Pyramidales.
    - Obliqui Aſcendentes Abdominis.

- The Anus, is
  - Purſed up, by Sphincter Ani.
  - Elevated, by—Elevatores Ani.

The Coccyx, is pulled forward, by Coccygei.

The Clavicles are drawn towards the Sternum, by Subclavii.

- The Scapula is moved
  - Backward
    - by Trapezius.
    - and Upward, by Rhomboides.
  - Forward
    - and Upward, by Serratus Major Anticus.
    - and Downward, by Serratus Minor Anticus.
  - Upward, by Elevator Scapulæ.

- The Os Humeri
  - is moved
    - Forward, by Pectoralis.
    - Backward, and Downward, by Latiſſimus Dorſi.
    - Upward
      - by Deltoides.
      - by Supraſpinatus.
      - by Biceps Flexor Cubiti.
      - and Outward, by Coracobrachialis.
    - Downward
      - and Backward, by Latiſſimus Dorſi.
      - and Prone, by Subſcapularis.
    - Outward and Upward, by Coraco brachialis.
    - Inward and Downward, by Subſcapularis.
  - is turned
    - Supine
      - and Backward, by Infraſpinatus.
      - and Downward, by Teres Minor.
    - Prone
      - and Backward, by Teres Major.
      - and Downward, by Subſcapularis.
- The Cubit or Fore-Arm
  - is Bent by
    - Biceps Flexor Cubiti.
    - Brachiæus Internus.
    - Supinator Radii Longus.
    - ——— Radii Brevis.
  - is Extended by
    - Triceps Extenſor Cubiti.
    - Anconæus.
  - is turned
    - Supina, by Supinatores.
    - Prone, by Pronatores.

The

The Carpus	is Bent by	Palmaris Longus.	
		Flexor Carpi Radialis.	
		—— Carpi Ulnaris.	
	is Extended by	Extenſor Carpi Radialis.	
		—— Carpi Ulnaris.	
The Palm of the Hand is conſtricted, by Palmaris Brevis.			
The Fingers	are Bent by	Lumbricales vel Flexor Primi—	Internodii Digitorum.
		Perforatus vel —— Secundi	
		Perforans vel —— Tertii—	
	are Extended by	Extenſor Digitorum Communis	
		—— Minimi Digiti.	
		——Indicis.	
	are moved Laterally by	Abductor Primi Digiti Interoſſei.	
		—— Minimi Digiti.	
		—— Oſſis Metacarpi Minimi Digiti.	
The Thumb	is Bent by	Flexor Primi	Internodii Pollicis.
		—— Secundi	
		—— Tertii	
	is Extended by	Extenſor Primi	Internodii Pollicis.
		—— Secundi	
		—— Tertii	
	is moved Laterally	Internally, by Adductor Pollicis.	
		Externally by Abductor Pollicis.	

The Thigh	is Bent	Rightly, by	Pſoas Magnus.
			Iliacus Internus.
		Obliquely, by	Pectinæus.
			Triceps Femoris.
	is Extended	Rightly, by	Glutæus Maximus.
			——— Minimus.
		Obliquely, by	Glutæus Medius.
			Pyriformis.
	is Turned	Outward, by	Obturator Externus.
			——— Internus.
			Faſcia Lata.
		Inward, by	Quadratus Femoris.
The Leg	is Bent by		Gracilis.
			Sartorius.
			Semitendinoſus.
			Semimembranoſus.
			Biceps Tibiæ.
			Popliteus.
	is Extended by		Membranoſus.
			Rectus Tibiæ.
			Vaſtus Externus.
			——— Internus.
			Cruræus.

The Tarſus	is Extended by		Gaſterocnemius.	
			Plantaris.	
			Solæus.	
			Flexor Pollicis Pedis Longus.	
			—— Digitorum Pedis Longus.	
	is Bent by		Extenſor Pollicis Pedis Longus.	
			— — Digitorum Communis.	
	is Turned	Inward, by	Tibialis Anticus.	
			——— Poſticus.	
		Outward, by	Peroneus Longus.	
			——— Brevis.	
The Four Leſſer Toes	are Bent, by		Lumbricales Pedis, in the Firſt	Joint.
			Perforatus Pedis, in the Second	
			Perforans Pedis, in the Third	
	are Extended by		Extenſor Digitorum Pedis Longus.	
			——— Digitorum Pedis Brevis.	
	are Moved laterally by		Abductor Minimi Digiti Pedis.	
			——— Secundus Minimi Digiti Pedis.	
			Interoſſei Pedis.	
The Great Toe	is Bent, by		Flexor Pollicis Pedis Longus.	
			——— Pollicis Pedis Brevis.	
	is Extended by		Extenſor Pollicis Pedis Longus.	
			——— Pollicis Pedis Brevis.	
	is Moved laterally by		Abductor Pollicis Pedis.	
			Adductor Pollicis Pedis Tranſverſalis.	
The Sole of the Foot is conſtricted by —			Plantaris.	
			Abductor Pollicis Pedis.	
			——— Minimi Digiti Pedis.	

Of

SECT. V.

Of the ARTERIES in general.

Artery deſcribed.

AN artery is a conical tube or canal, which conveys the blood from the heart to all parts of the body: it is compoſed of three membranes or coats; the external and internal are membranous, but the middle coat is rather muſcular, conſiſting of circular or ſpiral fibres. Theſe fibres being very elaſtic, contract themſelves with ſome force, when the power ceaſes by which they have been ſtretched out. The external coat ſerves to nouriſh the interior membranes, and the internal coat or membrane keeps the blood within its proper channels. The pulſe of the arteries conſiſts of two reciprocal motions, like the pulſes of the heart, being a ſyſtole and a diaſtole, keeping oppoſite times, the ſyſtole of the one anſwering to the diaſtole of the other.

The principal arteries of the human body are (ſtrictly ſpeaking) only two, viz. the aorta vel arteria magna, and the arteria pulmonalis: all the other arteries of the body, though diſtinguiſhed by particular names, are only branches of theſe two.

Aorta.

The aorta vel arteria magna, is a large artery which comes out from the left ventricle of the heart in a ſingle trunk, above its valves called ſemilunares vel ſigmoides; from this all the other arteries, either mediately or immediately proceed, and by which the whole maſs of blood is conveyed to all parts of the body.

Diviſions. The aorta is by anatomiſts generally divided into the aorta aſcendens, and aorta deſcendens, though both are but one and the ſame trunk; it is termed aſcendens, from where it leaves the heart to the extremity of the great curvature or arch; the deſcendens is that part of the trunk which, after the arch-like inflection, deſcends thro' the thorax and abdomen, down to the os ſacrum, and is uſually larger in women than in men. Before it perforates the pericardium, it affords to the heart itſelf the arteriæ coronariæ, and then paſſing the pericardium, Aorta aſcendens. it is termed aorta aſcendens, when, after aſcending two or three inches upwards, its trunk is bent in manner of an arch, from which ariſes three aſcending branches that form the carotid and ſubclavian arteries. The right carotid and ſubclavian proceed firſt in one trunk, but the left carotid and ſubclavian immediately ſingle; the left carotid forming the middle branch. From the two ſubclavian branches (while yet within the breaſt) near the uppermoſt rib proceeds, 1. arteria intercoſtalis ſuperior, proper to the four upper ribs; 2. arteria mammaria, proper to the breaſts; 3. cervicalis proper to the muſcles of the neck and head, and by communication partly to the brain; 4. carotis, the external proper to the larynx, tongue, neck, head, and brain; the internal, chiefly to the brain. When the ſubclavian branches have left the cavity of the thorax they are termed axillares, which carry nouriſhment to the outer parts of the breaſt and arms, by thoracica ſuperior et inferior; 3. ſcapularis; 4. humeralis; then they approach the arm, where they lie under the branches of the axillary vein, and paſs to all parts of the arm, bearing the ſame names with the veins that accompany them.

Aorta deſcendens.

This veſſel being reflected under the left lobe of the lungs, it commences aorta deſcendens; which name it keeps through the thorax and abdomen, where it paſſes on the left ſide of the ſpine, till its diviſion into iliac arteries between the third and fourth vertebræ of the loins. This deſcendent trunk, which is the greateſt, being yet within the capacity of the thorax, ſends, 1. intercoſtalis inferior, to the eight lower ribs; 2. bronchiales to the lungs; 3. phrenicæ, to the diaphragm; 4. cœliaca, whoſe branches are beſtowed upon the liver, pancreas, ſpleen, ſtomach, omentum, and duodenum; which are named from the parts they are beſtowed on, except two beſtowed upon the ſtomach, which are called coronaria ventriculi ſuperior et inferior, and one upon the duodenum named inteſtinalis: 5. meſenterica ſuperior, whoſe branches are beſtowed upon all the inteſtinum jejunum and ileum, part of the colon and ſometimes one branch upon the liver; 6. emulgentes, to the kidneys; 7. ſpermaticæ, to the peritonæum, ureters, teſticles and epidydimes; 8. lumbares, to the loins; 9. meſenterica inferior, to the lower part of the colon, and the rectum; 10. muſcula ſuperior, to the muſcles of the belly. As ſoon as the aorta divides upon the loins, it ſends off an artery into the pelvis, upon the os ſacrum, called arteria ſacra; and the branches the aorta divides into, are called iliacæ, which in about two inches ſpace, divide into external and internal. The iliacæ internæ ſend 1. arteria inferior, to the muſcles; 2. umbilicalis, which are collapſed in adult bodies, except at their beginnings, which are kept open for the collateral branches on each ſide, one to the bladder, and one to the penis or uterus. 3. hypogaſtrica. The reſt of the branches of the internal iliac are beſtowed upon the buttocks and upper parts of the thighs. The iliacæ externæ, run over the oſſa pubis into the thighs; ſending off, 1. epigaſtricæ, to the fore part of the integuments of the abdomen under the recti muſcles, into the pelvis, and alſo through the foramina of the oſſa inominata to the muſcles of thoſe parts; 2. inguinalis, to parts of the groin; 3. cruralis, to the thigh; 4. poplitea, to the ham; 5. tibialis antica, media, et poſtica, which ſupply the leg, foot, and toes.

The above is a general deſcription of all the large and ſmall capital branches of the aorta, which are for the moſt part diſpoſed in pairs, and are uniform in moſt bodies, but the leſſer branches are diſtributed, like the branches of trees, in ſo different a manner in one body from another, that it is highly probable no two bodies are exactly alike, nor the two ſides in any one body. The particular deſcription of theſe veſſels will be inſerted hereafter in their proper place, to which the reader is referred.

Arteria pulmonaris.

The arteria pulmonaris is diſtributed only through the lungs, but with a vaſt number of ramifications. It ariſes from the right ventricle of the heart, and ſoon divides into two branches, one to each lobe of the lungs; then they are ſubdivided into ſmaller and ſmaller branches, until they are diſtributed through every part of the lungs. The extreme branches, both of the arteries and veins, have very numerous communications, like thoſe in the ſtamina of the leaves of plants, by which communications the blood that is obſtructed in any particular veſſel may paſs off by other veſſels that are not obſtructed, &c. and as many of the leſſer veſſels are more expoſed to preſſure, than any of the large ones, thoſe communications in the leſſer veſſels are therefore made more numerous. By ſuch communications the blood circulates in a limb that has had part amputated, and the fluids contained in a large inflammation ſuppurates into one cavity. It is computed that each ventricle of the heart holds five ounces of blood; (and they are filled and emptied every ſyſtole and diaſtole) and that there is commonly eighty pulſes in a minute: if ſo, there then flows twenty-five pounds of blood through each ventricle of the heart in a minute. Dr. Keil has ſhewn that the ſum of all the fluids in a man exceed the ſum of all the ſolids, and yet the quantity of blood which all the viſible arteries of a man will contain, is leſs than four pounds; and if we may ſuppoſe all the viſible veins, including the vena portæ, hold four times as much, the whole then that the viſible veſſels can contain is not twenty pounds; but the whole that they do contain is but very little more than the veins can contain, ſeeing the arteries are always found almoſt empty in dead bodies. How much the inviſible arteries and veins contain, however, I mean thoſe which contain ſuch a compound fluid as is found in the larger

larger veſſels, there is no way to judge, unleſs we knew what proportion theſe veſſels bear to thoſe that carry the nutritious juices and ſerum (if there are ſuch) without the globuli of the blood.

It is probable that in all animals the velocity of the blood as well as the neceſſity of food, is, cæteris paribus, in proportion to their quantity of action. If ſo, it appears how thoſe animals which uſe no exerciſe, and whoſe blood moves extremely ſlow in the winter, can ſubſiſt without any freſh ſupply of food, while others that uſe a little more exerciſe, require a little more food; and thoſe who uſe equal exerciſe winter and ſummer, require equal quantities of food at all times; the end of eating and drinking being to repair what exerciſe and the motion of the blood have deſtroyed or made uſeleſs; and is not the leſs velocity of the blood in ſome animals than in others, the reaſon why wounds and bruiſes in thoſe animals do not ſo ſoon deſtroy life as they do in animals whoſe blood moves ſwifter?

Pulſe, The ſtructure of the arteries being already deſcribed, I ſhall now give ſome account of the pulſe.

Account of. When the left ventricle of the heart contracts, and throws its blood into the aorta or great artery, the blood in the artery is not only thruſt forwards towards the extremities, but the channel of the artery is likewiſe dilated; becauſe fluids, when they are preſſed, preſs again to all ſides, and their preſſure is always perpendicular to the ſide of the containing veſſels. But the coats of the artery by any ſmall impetus, may be diſtended; therefore, upon the contraction of the heart, the blood from the left ventricle will not only preſs the blood in the artery forwards, but both together will diſtend the ſides of the artery. When the impetus of the blood againſt the ſides of the artery ceaſes, that is, when the left ventricle ceaſes to contract, the ſpiral fibres of the artery, by their natural elaſticity, return again to their former ſtate, and contract the channel of the artery, till it is again dilated by the ſyſtole of the heart. This diaſtole of the artery is its pulſe, and the time the ſpiral fibres are returning to their natural ſtate is the diſtance between two pulſes. The pulſe is in all the arteries of the body at the ſame time, for whilſt the blood is thruſt out of the heart into the artery, the artery being full, the blood muſt move in all the arteries at the ſame time: and becauſe the arteries are conical, and the blood moves from the baſis of the cone to the apex, therefore the blood muſt ſtrike againſt the ſides of the veſſels, and conſequently every point of the artery muſt be dilated at the ſame time that the blood is thrown out of the left ventricle of the heart; and as ſoon as the elaſticity of the ſpiral fibres can overcome the impetus of the blood, the arteries are again contracted. Thus theſe are two cauſes, which operate alternately, and keep the blood in a continual motion, viz. the heart and fibres of the arteries; but becauſe the one is ſtronger than the other, therefore, though the blood runs continually, yet when the artery is opened, it is ſeen to move per ſaltum. See Chap. viii. Sect. 10.

S E C T. VI.

Of the VEINS in general.

Vein deſcribed.

A Vein is a veſſel which carries the blood from any of the body to the heart, and is compoſed principally of a membranous, a vaſcular, and a muſcular tunic; the ſame with thoſe of the arteries, only the muſcular coat is much thinner; as thin in all the veins, as it is in the capillary arteries; the preſſure of the blood againſt the ſides of the veins being leſs than that againſt the ſides of the arteries.

The veins are only a continuation of the external capillary arteries, reflected back again towards the heart, and uniting their channels as they approach it, till at laſt, they all form three large veins; the cava deſcendens, which brings the blood back from all the parts above the heart; the cava aſcendens, which brings the blood from all the parts below the heart; and the porta, which carries the blood to the liver. In the veins there is no pulſe, becauſe the blood is thrown into them with a continued ſtream; and becauſe it moves from a narrow channel to a wider. The capillary veins unite with one another, as has been ſaid of the capillary arteries. The veins ariſe from the extremities of the arteries (as above-mentioned) and make up trunks which accompany the arteries in almoſt every part of the body, and have the ſame names in the ſeveral places with the arteries which they accompany.

The veins of the limbs are more than double the number of the arteries, there being one on each ſide each artery, even to the ſmalleſt branches that we can trace, beſides the veins which lie immediately under the ſkin.

The external veins have frequent communications with the internal, and are always fulleſt when we uſe the moſt exerciſe; becauſe the blood being expanded by the heat which exerciſe produces, it requires the veſſels to be diſtended, and the inner veſſels being compreſſed by the actions of the muſcles they cannot dilate enough; but theſe veſſels being ſeated on the outſides of the muſcles, are capable of being much dilated.

Valves of veins.

In all the veins which are perpendicular to the horizon, excepting thoſe of the uterus, and the vena portæ, there are ſmall membranes or valves; ſometimes there is only one, ſometimes there are two, and ſometimes three placed together, like ſo many half thimbles ſtuck to the ſides of the veins, with their mouths towards the heart. In the motion of the blood towards the heart, they are preſſed cloſe to the ſides of the veins; but if the blood ſhould fall back, it muſt repel the valves, ſo that no blood can repaſs them, or return towards the extreme parts from whence it came. The blood, diſtributed to all parts of the body by two kinds of arteries, the aorta and the pulmonary, returns by three kinds of veins, called by anatomiſts, vena cava, vena portæ, and the pulmonary vein.

The vena cava carries back to the right auricle of the heart the blood conveyed by the aorta to all the parts of the body, except what goes by the coronary arteries of the heart. It receives all this blood from the arterial ramifications in part directly, and in part indirectly. The vena portæ receives the blood carried to the floating viſcera of the abdomen (by the cæliac artery, and the two meſenteric arteries) and conveys it to the hepatic vein, and from thence to the vena cava. The pulmonary vein conveys to the pulmonary ſinus, or left auricle of the heart, the blood carried to the lungs by the pulmonary artery.

Vena cava. The vena cava ariſes with a larger ſinus from the right auricle of the heart, where it firſt ſends out a vein to the heart itſelf, called the coronary vein, and is then divided into two trunks, one running upward, called vena cava deſcendens vel ſuperior, and the other running downward called vena cava aſcendens vel inferior, ſo named by the moderns, from the blood deſcending and aſcending through them to the heart; but the antients, reſpecting the direction of the tubes or veſſels only, called the cava ſuperior aſcendens, and the inferior deſcendens; therefore, to prevent miſtakes, I ſhall retain the above diſtinction of the moderns.

The deſcending or ſuperior trunk is diſtributed chiefly to the thorax, head, and upper extremities, and but very little to the parts below the diaphragm. The aſcending or inferior trunk is diſtributed chiefly to the abdomen and lower extremities, and but very little to the parts above the diaphragm.

Vena cava ſuperior. The vena cava ſuperior a little higher than the aorta, as high as the cartilage of the firſt true rib, terminates by a bifurcation or diviſion into the right and left ſuclavian branches, which are of unequal lengths, becauſe the trunk of the vena cava lies more towards the right ſide, where the left ſubclavian ariſes as well as the right, and is conſequently longeſt. From the heart to the bifurcation of the trunk of the ſuperior cava ariſe the following veins, viz. 1. the vena (azygos) ſine pari, which ſend branches to the eight lower ribs, and another to the left emulgent vein; 2. intercoſtalis ſuperior, one on each ſide, which afford branches to the four upper ribs (if the azygos doth not beſtow branches on all the interſtices of the coſtæ) the remarkable veins and arteries as well as nerves relating to the coſtæ, are couched in a furrow on the under edge of each rib, where they ſafely paſs; 3. bronchialis, which accompanies the bronchial artery to return the blood to the cava. This vein in ſome ſubjects, indeed, does not riſe ſeparate, but comes from the azygos, and ſometimes from the intercoſtals, and in ſome is altogether wanting. The following ſmall branches alſo ariſe (between the heart and the bifurcation of the ſuperior cava) on the right ſide, but on the left ſide they proceed from the left ſubclavian, viz. mediaſtina, pericardia, diaphragmatica ſuperior, thymica, mammaria interna, and trachealis. After this, the cava paſſeth to the clavicle where it divideth itſelf (as above) into a right and left ſubclavian branch, when each ſends off the following ſmall branches (beſides thoſe above-mentioned, which peculiarly belong to the left ſubclavian) viz. cervicalis, to the muſcles that reſt on the vertebræ, and medulla ſpinalis; and muſculoſa inferior, for the lower muſcles of the neck and upper of the breaſts. The ſubclavians ſend off alſo four capital branches, viz. jugularis externa et interna, vertebralis, and axillaris, but this laſt is rather a continuation than a branch of the ſubclavian. 1. Jugularis externa, chiefly to the external parts of the throat, neck and head. This, in its ſub-diviſions, receives different denominations from the parts over which they are diſtributed, as the frontalis, temporalis, occipitalis, &c. 2. Jugularis interna, to the internal parts of the head and neck; which gives ramifications to the larynx, pharynx, the muſcles of the os hyoides, and to the tongue: and beſides theſe, its trunk terminates in a ſack, and brings back the blood from the brain and ſinuſes of the dura mater. 3. Vertebralis, which aſcends to the cranium through the tranſverſe apophyſes of the vertebræ of the neck; and with the cervicalis (which is generally a branch of this vein) ſupplies the muſcles of the neck, accompanying the vertebral artery through all the tranſverſe apophyſes of the vertebræ colli all the way to the great foramen occipitale, communicating with the occipital veins, and ſmall occipital ſinuſes of the dura mater. The ſubclavian branch going out of the thorax on each ſide is termed, 4. axillaris, which is rather a continuation of the ſubclavian, than a diſtinct branch; before it leaves the thorax it ſends off venæ thoracicæ, which are ſpent on the muſcles of the thorax. From the axillaris (after it leaves the capacity of the thorax) proceeds muſcularis and ſcapularis, for the external and internal muſcles of the ſcapula, &c. and for the axillary glands. Having reached the ſide of the head of the os hu-

humeri, it ſends forth cephalica, to the arm (which creeps along between the ſkin and the muſcles) the axillaris then runs along the arm by the name of vena baſilica, but both this and the cephalica, may be looked upon as two principal branches of the axillaris; both are diſtributed by numerous ramifications to all parts of the arm, fore-arm and hand. At the bend of the elbow (or flexure of the cubit) they form three capital branches; the uppermoſt is called cephalica, the middle mediana and the next baſilica. Finally, that which runs over the back of the hand towards the little finger, is called the ſalvatella.

Vena cava inferior.

The vena cava inferior is remarkable for its valves, which ſerve to prevent the blood from returning towards the extremities; 1. immediately after it paſſes out of the pericardium it perforates the diaphragm, to which it gives the venæ diaphragmaticæ inferiores, or phrenicæ; 2. hepaticæ, to the liver; 3. renales vel emulgentes, to the kidneys; 4. ſpermaticæ, to the teſticles; 5. lumbares, to the loins and their vertebræ. After this, the trunk having reached the os ſacrum, it there loſes the name of cava, and, terminating by a bifurcation like that of the deſcending aorta, it ſends off the vena ſacra to accompany the artery of the ſame name, and then divides into the two venæ iliacæ, each of which is divided into two large trunks, or ſecondary iliac veins; this ſecond bifurcation is about a finger's breadth below that of the iliac arteries. The original iliacs, are diſtinguiſhed into the right and left; and the ſecondary iliacs (which are four trunks) are named external and internal, or anterior and poſterior. The two external trunks are alſo named ſimply iliaca, and the two internal, hypogaſtrica; the former ſeems to be a true continuation of the original iliac trunk, but the latter only a branch, I mean in adult bodies, for in a fœtus there is a manifeſt difference. From the hypogaſtrica, ariſe the muſculares, hæmorrhoidales externæ, and other branches to the parts of generation, bladder, anus, &c. From the external branches goes the epigaſtrica to the muſcles of the belly and hips. After this the iliac branches paſſing out of the abdomen are termed cruralis and from thence ariſe, 1. ſaphena, paſſing between the muſcles and integuments (only covered with the ſkin and fat) from the inguen to the knee, ancle, upper part of the foot and great toe; 2. ſaphena minor, to the back part of the thigh and leg, and to the heel; 3. poplitea, formed of a double crural branch, runs through the ham, on the back of the gaſtrocnemii to the tendo Achillis; 4. tibialis anterior runs down the fore-part of the leg, between the muſculus tibialis anticus, and the extenſor digitorum communis, to the upper part of the foot; 5. tibialis poſterior, vel ſuralis, is diſtributed through the calf and back part of the leg (as the anterior is on the fore-part) down to the heel and foot; 6. peronæa runs down on the inſide of the tibula, as low as the outer ancle, ſometimes double, ſometimes triple, ſending ramifications to the neighbouring portions of the muſculi peronæi, and long flexors of the toes.

Vena portæ. The vena portæ in its ſtructure has ſome reſemblance to a tree, being divided into innumerable branches, which are diſperſed throughout the whole ſubſtance of the liver. Where the trunk begins to divide, it conſtitutes the ſinus portæ in the liver, and from this proceeds the numberleſs ramifications as above-mentioned. The roots, or inferior branches of this vein, are divided into right and left; but firſt the trunk ſends off, 1. cyſticæ gemellæ to the veſica fellis; 2. gaſtrica dextra to the ſtomach: 3. duodenalis vel inteſtinalis, to the inteſtinum duodenum; and from this laſt often proceeds the pancreaticæ. From the right branch (before mentioned) ariſe, 1. meſeraicæ, to the meſentery and inteſtines; 2. hæmorrhoidalis interna, to the rectum; 3. epiploicæ dextræ, to the caul, the right ſide of the cæliac artery.

From the left branch, which paſſeth to the ſpleen and is called ſplenica, ariſe, 1. gaſtricæ, (which are various); 2. coronaria ventriculi, proceeding from the former, and diſtributed on the ſtomach; 3. vaſa brevia, which are formed by ſome of the branches of the coronaria ventriculi and ſplenica; 4. epiploica ſiniſtra, and 5. gaſtro-epiploicæ to the caul and ſtomach, the left ſide of the cæliac artery; 6. pancreaticæ, to the pancreas; and ſometimes alſo the hæmorrhoidalis interna.

All venal branches may be accounted the roots, in regard that their leſſer branches firſt reſorb the reſiduous blood, depoſited in any part by the arteries, and carry the ſame into their greater branches, and ſo into the trunk. Thus the blood is carried by the veins and their branches to the liver; and from all parts of the body by the branches of the cava into its aſcending and deſcending trunk which convey it to the heart.

Vena pulmonaris.

The vena pulmonaris ariſes from the left venticle of the heart, where it firſt forms a ſinus, then is divided into four branches, and afterwards into innumerable ramifications which are diſtributed through the whole ſubſtance of the lungs, and accompany the pulmonary artery, to return the blood into the heart.

The diſtribution of the veins is ſo various that it is rare to ſee ſubcutaneous veins in any two perſons alike.

SECT. VII.

Of the NERVES in general.

Nerve deſcribed.

A Nerve is a fibroſe, white and cylindrical part, wrapt up in the dura and pia mater, which laſt covers all the nerves in common, and alſo incloſes every fibre in particular.

To theſe membranous coats, an infinite number of veſſels, both arteries and veins, are diſtributed.

Beſides the blood-veſſels and membranes with which the nerves are ſurrounded, they are compoſed as it were of bundles or cluſters of white, cylindrical, and very ſlender filaments, ariſing from the brain, or rather from its medulla oblongata within the ſkull, and from the ſpinal marrow; from thence, they run to every part of the body, and on the ſtricteſt microſcopial obſervation, appear to be ſolid, and without any cavity; though ſome, miſtaking the cut orifices of the arterious and venous veſſels, juſt now mentioned, for nervous tubes, have affirmed their cavities to be viſible. But though we cannot diſcover any cavity, much leſs a fluid contained in them, yet it is very poſſible there may be ſuch cavities, and alſo highly probable (from the experiments of Bellini and others) that there is ſuch a fluid, though too ſubtile to be perceived by us.

Animal ſpirits, what.

This fluid (named animal ſpirits) is ſuppoſed to be conveyed by the nerves to all parts of the body, being an extreme ſubtile fluid, ſecreted in the brain and ſpinal marrow, and is thought to be deſtined for no leſs noble a purpoſe than the ſenſation, motion, and nutrition of the ſeveral parts of the human ſtructure. Anatomiſts, however, are ſo little agreed, and ſo many diſputes have ariſen upon this ſubject, that I ſhall not pretend to decide concerning them: though I am greatly inclined to favour the above opinion, not only from the experiments of Bellini and many others, but becauſe the nerves proceeding from the brain bear a great analogy to the excretory ducts of other glands; and as they are likewiſe far from being tenſe. I cannot join with thoſe who think ſenſation and motion are entirely occaſioned by a vibration communicated to the nerves. All anatomiſts are now convinced that to the nerves we owe all our ſenſation and motion; but the manner how this is produced, is ſtill the ſubject of diſpute.

Conſent of parts.

The harmony and ſympathy of the nervous parts is of great uſe in phyſick, for without an accurate knowledge of this, many ſymptoms of diſeaſes can ſcarcely be explained. There is a wonderful connection, ſympathy, and communication of motion as well as ſenſation, when they are affected by any violent cauſe: all which is owing to the nerves; for when any violence is offered them ſo as to threaten a ſolution of union, it creates a pain, and ſtricture of the adjacent, and even of the remote parts, eſpecially of the veſſels.

Origin of the nerves, &c.

All the nerves of the human body come originally from the cerebrum or cerebellum, by means of the medulla oblongata, or medulla ſpinalis. They go out in bundles, regularly diſpoſed in pairs, like ſo many diſtinct trunks, which are afterwards divided into branches and filaments, and diſtributed even to the ſmalleſt part of the body, as appears from their exerting themſelves every where; though all the nerves in the body, joined together, hardly make a cord of an inch diameter.

Diviſion.

The nerves are divided into thoſe which come immediately out of the cranium, and thoſe which come out between the vertebræ.

Nerves of the brain.

The firſt come from the brain or medulla oblongata, and are ten pair, viz. 1. the olfactory pair, which paſſing through the os cribroſom, vel æthmoides, vel cribriforme, are ſpread over the membrane of the noſtrils; 2. the optic pair, which by their expanſion, form the retina of the eye; 3. the motary pair of the eyes, each of which is divided near the orbit, into ſix parts or branches; the firſt branch goes to the elevator palpebræ; the ſecond, to the elevator occuli; the third, to the depreſſor; the fourth, to the adducens; the fifth, to the obliquus inferior; and the ſixth, into the tunics of the eye; 4. the pathetic pair are very ſmall, and run to the obliquus ſuperior or trochlear muſcle of the eye; 5. the guſtatory pair which are very large, and divided within the cranium into three branches, immediately under the dura mater. Of theſe, the firſt branch, called the opthalmic, runs to various parts of and about the eye, the eye lids, the muſcles of the forehead and noſe, and the integuments of the face. The ſecond branch, may be called the ſuperior maxillary one, as being finally diſtributed through all parts of the upper jaw, the lips, noſe, palate, uvula, gums, and teeth; a branch of it alſo runs to the ear, and joining with a branch of the ſeventh pair, forms the chorda tympani. The third branch, may be called the maxillaris inferior, as being diſtributed over the ſeveral parts of the lower jaw, the tongue, and other parts of the mouth; whence the whole pair of nerves has obtained the name of par guſtatorium; though a great part of them ſerves to very different purpoſes, and is carried to parts that have nothing to do with taſting; 6. the abducent pair (except a branch for the formation of the intercoſtal nerve) is wholly carried to the abducens oculi, whence its name. The intercoſtal nerve is formed either of ramifications of the two preceding nerves, or only of thoſe of the ſixth pair. It makes its way out of the cranium by the paſſage of the internal carotid, and deſcends near the eighth pair through the neck; and thence through the breaſt, and abdomen, even to the pelvis; making in its way various plexuſes and ganglia, and ſending branches to almoſt all the parts contained in the breaſt, and abdomen. 7. The auditory pair ariſe with two trunks, one of which, is called the portio dura and the other portio mollis: this laſt enters the foramen of the os petroſum, and thence through various little apertures gets into the labyrinth of the ear, where it is expanded over all its parts, and conſtitutes the primary organ of hearing.

The harder portion, paſſing through the aquæductus Fallopii, ſends back one branch into the cavity of the cranium; it alſo ſends off another branch, which helps to form the chorda tympani; and others, to the muſcles of the tympanum; the reſt of this pair, goes to the external ear, the pericranium, the muſcles of the os hyoides, the lips, the eyelids, and the parotids. 8. The par vagum with the acceſſorius Williſii, paſs out near the lateral ſinuſes of the dura mater, and, deſcending through the neck and thorax to the abdomen, ſend out branches by the way to the larynx, the pharynx, heart, lungs, and eſpecially to the ſtomach; it alſo ſends off, from the upper part of the thorax, large branches, which are variouſly implicated in the neck, thorax, and abdomen, with the linguals, the cervicals, and the intercoſtals. 9. The lingual pair go immediately to the tongue, and are called by ſome, the motary nerves of the tongue; but by others, with more juſtice, the guſtatory nerves. 10. This pair comes out from the beginning of the medulla ſpinalis, betwixt the os occipitis, and firſt vertebra colli, and is all (except what goes to the ganglion of the intercoſtal) ſpent on the muſculi obliqui, and extenſores capitis. But we are to obſerve, ſays Heiſter, that the pair of nerves, which the generality of writers have called the tenth pair of the head, are, for many unanſwerable reaſons, to be properly called the firſt pair of nerves of the neck.

Nerves of the medulla ſpinalis.

The ſecond kind of nerves, or thoſe which come out between the vertebræ, ariſe from the medulla ſpinalis, and are generally reckoned thirty pair; viz. 1. the nerves of the neck, are eight pair; 2. the nerves of the back, twelve pair; 3. the nerves of the loins, five; 4. and thoſe of the ſacrum form five or ſix pair; though not always determinately, and regularly ſo.

Nerves of the neck.

1. From the nerves of the neck are innumerable branches diſtributed through the muſcles of the head, neck, ſcapula, and humerus; from the third, fourth, and fifth pair, are formed the nerves of the diaphragm; and the ſixth, ſeventh, and eighth pair, together with the firſt pair of the back, form the ſix robuſt nerves of the arms and hands. To this diviſion, are the acceſſory ſpinal nerves of Willis to be referred, which ariſe about the origin of the third or fourth pair.

Nerves of the back.

2. The nerves of the back, beſides the branch they give to the brachial nerves, run entirely in the ſame furrow along the courſe of the ribs, and are diſperſed over the pleura, the intercoſtal, pectoral, and abdominal muſcles, the breaſt and other parts of the thorax.

Nerves of

3. The nerves of the loins are generally diſperſed over the loins, the peritonæum, integuments and muſcles of the abdomen; and beſides this, their firſt pair often gives, on each ſide, a branch to the diaphragm. The ſecond pair, after inoſculating with the branches of the firſt, third, and fourth pairs,

forms the crural nerves, which are diſtributed over the anterior part of the thigh; and in the ſame manner, a branch is formed of the conjunctions of the ſecond, third, and fourth pair, which paſſes through the great foramen of the os pubis, to the ſcrotum, teſticles, and the adjoining parts. The fourth and fifth pair of the nerves of the loins, joining with the firſt, ſecond, third and fourth pair of the os ſacrum, compoſe the nerve called iſchiatic, which is the largeſt in the body. It deſcends along the hinder part of the thigh, and its branches are diſtributed over the whole leg, the foot and toes.

Nerves of the ſacrum. 4. The nerves of the ſacrum form five or ſix pair, and paſs through the foramina of this bone: the ſuperior of them, as already obſerved, compoſe the iſchiatic nerve; and what remains is diſperſed in a multitude of ramifications over the parts contained in the pelvis, the inteſtinum rectum, the bladder, the parts of generation, and the parts adjacent.

The nerves generally run as ſtrait as the parts of the body and their own ſafety from external injuries will admit; ſending off their branches at very acute angles, and conſequently running more parallel than the blood veſſels. Frequently nerves which come out diſtinct or ſeparate, afterwards conjoin into one faſciculus or bundle, under the ſame common covering; and in ſome parts, where there are ſuch conjunctions, the bulk of the nerves ſeems much increaſed, and theſe knotty oval bodies called by Fallopius, corpora olivara, and generally now named ganglions, are formed. The coats of theſe knots are ſtronger, thicker, and more muſcular than the whole nerves which enter into them would ſeem to conſtitute, while the nervous fibrils paſs through without any great alteration or change.

The nerves ſeem, when examined with a microſcope, to be bundles of ſtrait fibres or threads, running parallel and not communicating with one another: and I am inclined to think, that every the minuteſt nerve, terminating in any part, is a diſtinct cord from its origin in the brain or ſpinal marrow; or elſe I do not ſee how they could produce diſtinct ſenſations in every part of the body; and the diſtinct points of ſenſation throughout the body are ſo very numerous, that the whole body of nerves (which taken together would not make a cord of an inch diameter) muſt be divided into ſuch a number, to afford one for every part that has a diſtinct ſenſation, that ſurely ſuch a nerve would be too ſmall to be ſeen by the beſt microſcope.

What proves the exiſtence of a liquid (called animal ſpirits) in the cavities of the nerves, next to a demonſtration, is the following experiment (made firſt by Bellini) viz. after opening the thorax of a living dog, catch hold of and compreſs the phrenic nerve, immediately the diaphragm ceaſes to act; remove the compreſſing force, that muſcle again contracts; gripe the nerve with one hand ſome way above the diaphragm, that ſeptum is unactive; then with the other hand ſtrip down the nerve from the firſt hand to the diaphragm, this muſcle again contracts. After once or twice having ſtripped the nerve thus down or exhauſted the liquid contained in it, the muſcle no more acts, ſqueeze as you will, till the firſt hand is taken away or removed higher, and the nerve ſtripped, i. e. the liquids in the ſuperior part of the nerve have free acceſs to the diaphragm, or are forced down to it, when it again will move.

That the nerves are inſtruments of ſenſation is clearly proved from experiments, but how they convey thoſe ſenſations to the brain, is matter of diſpute, as I have before obſerved. Though probably ſome nerves may be ſo ſmall as to eſcape even microſcopial obſervation; yet nevertheleſs, they may be tubes; and poſſibly a fluid, whoſe coheſion is very little, and whoſe parts no finer than light, may move freely in them.

Thoſe who deny animal ſpirits in the nerves, ſuppoſe that the ſenſation is conveyed by a vibration; which though it ſeems to me improbable, yet it is poſſible it may be conveyed either, or both ways: but it is at preſent undetermined.

A Compendious View of all the ARTERIES, VEINS, and NERVES; with the Parts they are diſtributed to.

PARTS.	ARTERIES.	VEINS.	NERVES.
On each Side of the Hairy Scalp.	Carotis Externa, in general. Temporalis. Occipitalis. Angularis, by Communication. Vertebralis by Communication. Carotis Interna, by Com.	Jugularis Externa in general. ——— Externa Poſterior. Temporalis. Occipitalis. Vertebralis. Jugularis Externa Anterior ⎫ by ——— Interna ——— ⎭ Com. Sinus Lateralis Duræ Matris, by Communication. Axillaris, by Communication. Cephalica, by Communication.	Nervi Sub-Occipitales, commonly called the 10th Pair from the Medulla Oblongata. Par Nonum, from the Med. Oblongata. —— Primum Cervicale. —— Secundum Cervicale, by Communication. Diaphragmatici, by Communication. Ramus Frontalis of the Orbitrar, or Opthalmic Nerve. Sympatheticus Minor, called the Portio Dura of the Auditory Nerve. Sympatheticus Medius, or Par Vagum from the Med. Ob. by Com. Symp. Maximus, commonly called Intercoſtalis by Communication.
The Exteriors, which belong to each Side of the Face.	Carotis Externa. ——— Interna, by Communication. Vertebralis, by Communication.	Jugularis Externa, in general. ——— Interna, by Communication. Vertebralis, by Communication.	Olfactorius. Opticus. Opthalmicus, which is the 1ſt Branch of of the 5th Pair from the Medulla Oblongata. Maxillaris Superior. ——— Inferior. Patheticus. Abducentes. Sympatheticus Minimus, Medius, and Maximus. Hypogloſſus Externus, or 9th Pair. Nervi Cervicales, the 2d Pair.

PARTS.	ARTERIES.	VEINS.	NERVES.
The Forehead.	Temporalis, which is a Branch of the External Carotid. Angularis, which is a Branch of the Internal Carotid. Carotis Interna, by Communication.	Frontalis. Temporalis. Angularis: Sinus Orbitarius. Sinus Longitudinalis Sup. } by —— Longitudinalis Inf. } Com. Jugularis Interna, by Communicat.	Ophthalmicus. Maxillaris Superior. ——— Inferior. Sympatheticus Minor, which is the Portio Dura of the Nervus Auditorius.
The Eye.	Temporalis, which is a Branch of the External Carotid. Maxillaris Externa. ——— Interna, both which are Branches of the External Carotid. Carotis Interna.	Temporalis, which is a branch of the Poſterior External Jugular. Angularis, which is a Branch of the Anterior External Jugular. Frontalis, which is a Branch of the Anterior External Jugular. Jugularis Interna, by Communicat. Sinus Orbitarius. —— Longitudinalis, by Communication.	Olfactorius, by Communication. Opticus. Motores Oculorum, or the 3d Pair. Trochleares, or the 4th Pair. Ophthalmicus } of the 5th Pair. Maxillaris Superior } of the 5th Pair. Abducentes, or the 6th Pair. Sympatheticus Minor, or the Portio Dura of the Auditory Nerve. Sympatheticus Maximus, or Intercoſtalis.
The Noſe.	The ſame Arteries with thoſe which go to the Eye, among which, the Internal Carotid ſupplies the Noſe, by Communication. Arteri Labiorum Orbicularis, by Communication.	All the Veins already mentioned, as belonging to the Eye.	Olfactorii. Orbitarius, vel Ophthalmicus, (which is a Branch of the 5th Pair) both immediately, and by Communication. Motores Oculorum, or the 3d Pair, by Communication. Maxillares Superiores, Branches of the 6th Pair. Sympatheticus Minimus. Sympatheticus Medius, by Commun.

The Ear.	Temporalis, a Branch of the External Carotid. Auriculariis, a Branch of the Temporalis. Occipitalis, by Communication. Vertebralis, by means of the Arteria Baſilaris, which is a Continuation of it. Carotis Interna, by Communication with the Arteria Baſilaris.	Temporalis. Occipitalis } Theſe three being Cervicalis } Branches of the Ju- Maxillaris } gularis Externa. Jugularis Interna, by ſeveral Communications. Sinus Petroſus. Duræ Matris.	Maxillaris Inferior, the 3d Branch of the 5th Pair. Auditorius. Sympatheticus Minimus, the Portio Dura of the Auditory Nerve. Hypogloſſus Externus, the 9th Pair by Communication. Sub-Occipitalis, the 10th Pair by Communication. The Second Pair. Sympatheticus Medius, the 8th Pair. ——— Maximus, vel Univerſalis, commonly called Intercoſtales.
The Mouth, Tongue, Salivary Glands, &c.	The Artery of the Chin; Coronaria, vel Orbicularis Labiorum; both being Branches of the External Carotid. Maxillaris Interna. Sub-Lingualis.	Maxillaris Externa; ——— Interna; Raninæ; all theſe are Branches of the External Jugular. Jugularis Interna, by ſeveral Communications. Gutturalis Superior, a Branch of the Internal Jugular. Axillaris, when it ſends off the Guttural Vein.	Maxillaris Superior. ——— Inferior, both Branches of the 5th Pair. Sympatheticus Minimus, or Portio Dura of the Auditory Nerve. Sympatheticus Medius, or Par Vagum. Par Linguale, or 9th Pair. The ſecond pair of Cervical Nerves. Sympatheticus Maximus, by Communication.
The Cheeks.	Temporalis. Maxillaris Externa. ——— Interna.	Temporalis. Maxillaris Externa. ——— Interna.	Sympatheticus Minimus. or Portio Dura of the Auditory Nerve. Maxillaris Superior. ——— Inferior.

PARTS.	ARTERIES.	VEINS.	NERVES.
The Neck.	Carotides in general. ——— Externæ. ——— Internæ. Vertebrales. Cervicales.	Jugulares in general. ——— Externæ. ——— Internæ. Cervicales. Vertebrales.	Sympathetici Minimi, or the Portio Dura of the Auditory Nerves. Sympathetici Medii, or Par Vagum. Acceſſorii Williſii. Hypogloſſus Externus, or 9th Pair. Sub Occipitales, or 10th Pair. The Seventh Cervical Pair. Sympathetici Maximi.
The Thorax.	Thoracicæ Superiores. ——— Inferiores. Mammariæ Internæ. ——— Externæ. Intercoſtales Superiores. ——— Inferiors. Spinales, with the Venal Sinuſes of the Canal of the Spine.	Thoracicæ Superiores. ——— Inferiores, Mammariæ Internæ. ——— Externæ. Intercoſtales Superiores. ——— Inferiores. Spinales, with the Venal Sinuſes of the Canal of the Spine.	Sympathetici Medii, or the 8th Pair. Sympathetici Maximi, commonly called Intercoſtales. The laſt Cervical Pair. The Twelve Dorſal Pairs. Diaphragmatici.
The Abdomen.	Epigaſtrica Superior, which is the lowest portion of the Mammaria Interna. Aorta Inferior. Cæliaca. Meſenterica Superior. Renales vel Emulgentes, Spermaticæ. Meſenterica Inferior. Lumbares. Iliacæ. Hypogaſtricæ. Epigaſtricæ Inferiores. Hæmorrhoidales. Pudicæ.	Mammariæ Internæ. Renales. Lumbares. Spermaticæ. Iliacæ. Hypogaſtricæ. Portæ Ventralis. ——— Hepatica. Meſaraica Major. Splenica. Meſaraica Minor, ſive Hæmorrhoidalis Interna.	Stomachici, formed by the Extremity of Sympathetic Medii, or 8th Pair. Sympathetici Maximi, the Inferior Portion. The Two Semilunar or Plexiform Ganglions. Plexus Stomachicus. ——— Hepaticus. ——— Splenicus. ——— Renales. ——— Meſentericus Superior. ——— ——— Inferior. Lumbares. Sacri. Crurales, their Origin. Sciatici, their Origin.

The Arm, &c. including the whole Upper Extremity.	Axillaris. Humeralis. Scapulares. Articularis. Brachialis. Collaterales. Cubitalis. Radialis.	Cephalica Minor. Jugularis Externa, by Communication with the ſmall Cephalica. Axillaris. Muſculares. Scapulares. Brachii Cephalica. ——— Baſilica. Satellites, Arteriæ Brachialis. Profunda Superior. Mediana { Cubitalis. Baſilica. Radialis, vel Cephalica. Media, or Major.	Brachiales in general, formed by the laſt Four or Five Cervical and firſt Dorſal Pairs. Muſculo-Cutaneus. Medianus. Cubitalis. Cutaneus Internus.
The Arm, &c. including the whole Upper Extremity.	Interoſſea Anterior. Interoſſeæ Poſteriores. The Arterial Arches in the Palm of the Hand.	Profunda Cubiti. Baſilica Cubiti, vel Cubitalis. Cephalica Cubiti, vel Radialis. Cubiti Satellites. Cephalica Pollicis. Salvatella, ſive Auricularis. Areolæ Venoſæ Dorſi manus.	Radialis. Axillaris ſive Auricularis.
The Thigh, Leg, and Foot.	Obturatrix; a Branch of the Hypogaſtrica. Glutæa, a Branch of the Hypogaſtrica. Sciatica, by Communication. Pudica, by Communication. Cruralis. Poplitea. Tibialis Anterior. ——— Poſterior. Peronea. Plantaris.	Obturatrix. Glutea. Cruralis. Magna Saphena. Sciatica. Parva Saphena, vel Saphena Externa. Poplitea. Tibialis. Peronea. Plantaris.	Cruralis, formed by a Complication of the five Lumbares, eſpecially of the firſt Four. Sciaticus, formed by the Union of the laſt Two Lumbares, and firſt Three Sacri. Sympatheticus Max. by Communication with the Nervi Lumbares and Sacri. Popliteus. Sciaticus Internus, vel Popliteus Internus. Sciaticus Externus, vel Popliteus Externus. Plantaris Externus. ——— Internus.

SECT. VIII.

Of the LYMPHÆDUCTS, or LYMPHATIC VEINS.

TILL within theſe few years, it had been univerſally the opinion of anatomiſts that the lymphatic veins were a continuation of arteries of the ſame claſs; but by the experiments of Dr. Hunter and Dr. Monro, it is now clearly evinced that they are not a continuation of arteries, but a ſyſtem of abſorbing veſſels. I ſhall briefly relate the arguments adduced in ſupport of this opinion.

That the lymphatic veins are not continuations of arteries, would ſeem evident from this circumſtance, that they cannot be injected, as other veins, by filling the arterial ſyſtem. It has ſometimes been obſerved in injecting, that the lymphatic veins were immediately filled with wax, which on the burſting of the arteries was effuſed into the cellular membrane; from whence it would appear that they derived their origin from thoſe cells.

If they were continuations of arteries, it is aſked why they ſhould be ſo plentifully provided with valves, which are not found in the other veins of the viſcera? This remarkable difference in the conſtruction of the lymphatic and other veins greatly corroborates the doctrine of their origin being totally diſſimilar. In all other veins the fluids move onwards by an *impetus* received in the arterial ſyſtem; but the caſe is not the ſame in veſſels that ſuck up a fluid from a ſurface. Theſe require valves, that every lateral preſſure upon them may have the effect of an impulſe at the beginning of the canal, in driving the fluid onwards to their extremities.

Beſide the arguments above mentioned in reſpect to the peculiar origin of the lymphatic veſſels, Dr. Hunter ingeniouſly obſerves that this doctrine is farther confirmed by the abſorption of the venereal poiſon, which we know may be received at any part of the body, and thence diffuſed through the whole. We muſt ſuppoſe it to be tranſmitted by the ſame veſſels that imbibe its antidote, mercury, or any thing elſe that is carried into the maſs of blood by abſorption. Thoſe things being of a more inoffenſive nature, paſs unobſerved; but this poiſon, from its irritating and deſtructive quality, is apt to raiſe diſturbance before it is mixed with the blood. Hence the lymphatic glands, through which every abſorbed liquor muſt paſs, are ſo often the parts firſt affected by the venereal taint. This is the theory of the venereal *bubo*. If the infection be received in the moſt common way, the *bubo* happens in the groin, becauſe the lymphatics of the genitals paſs through the inguinal glands; but if the infection be received at the hand (a caſe that ſometimes occurs) the *bubo*, for the like reaſon, is formed in the arm-pit. When the diſeaſe is communicated by the lips, the glands of the neck inflame and tumify.

The great analogy between the lymphatics and lacteals is likewiſe urged in ſupport of the doctrine of the former being abſorbent veſſels. Theſe two ſyſtems, it is obſerved, are the ſame, to all appearance, in their coats, their valves, their manner of ramifying,

fying, their paſſage through the lymphatic or conglobate glands, and their termination in the route of the chyle. As they are perfectly ſimilar in every other reſpect, we muſt conclude them to be ſo in their origin and uſe. The lacteals are known to begin from the ſurface of the inteſtines, and to be the abſorbents of thoſe parts. There is no difference but the name. The ſame veſſels are called lacteals in the inteſtines, and lymphatics in the other parts of the body.

When to the arguments drawn from reaſon and analogy, are added the experiments, upon the evidence of which this doctrine is founded, we muſt admit its reality to be unqueſtionable. The experiment that ſuggeſted it to Dr. Hunter was his injecting the vas deferens in the human body with mercury, by which method he filled the whole epididymis; and he obſerved, during the operation, that the mercury continued to run, and the body of the teſtis to become gradually more turgid and heavy, for ſome time after the internal parts were completely filled. Shewing this preparation next night at his public lecture, he declared his opinion that the internal tubuli were likewiſe filled; but forbearing to ſacrifice ſo valuable a preparation to the proof of his conjecture, the experiment was ſoon afterwards repeated by Mr. Hunter, his brother, for the ſake of a demonſtration, when, upon opening the teſtis, it was found, according to the doctor's prediction, that the tubular internal ſubſtance was generally filled with mercury.

From the brief account of this ſubject above delivered, the doctrine of the lymphatics being a ſyſtem of abſorbing veſſels ap-

appears to be clearly eſtabliſhed. They are therefore not continuations of arteries, but have their origin in all the cavities and cellular ſubſtance of the body. They are more numerous in glands than other parts, eſpecially in thoſe glands which ſeparate the viſcideſt fluids, as may be obſerved in the liver and teſtes.

The lymphatics have but one diſcernible coat, which is very thin, having valves at ſmall and uncertain diſtances, to prevent the regreſs of their fluid. They have frequent communications, like the veins. The larger trunks are in many places attended with ſmall glands, through which they run, and at the ſame time ſend communicant branches over them, as a ſecurity againſt obſtructions from diſeaſes in thoſe glands. They all ultimately terminate in the receptaculum chyli.

The uſe of the lymphatics is to dilute the chyle and abſorb the fluids which are thrown into the ſeveral interſtices of the body, thereby preventing any morbid accumulation. When a lymphatic veſſel burſts, it occaſions a dropſy in the cavity into which it opens.

SECT. IX.

Of the VASA LACTEA.

Lacteal veſſels.

THE vaſa lactea, or lacteal veſſels, are the venæ lacteæ, receptaculum chyli, and ductus thoracicus, filled with a white, milky fluid, called chyle. See Chap. viii. Sect. 7. Of the Chyle, and Chylification.

Venæ Lacteæ, &c. The venæ lacteæ, &c. have the name of veins, becauſe their valves are diſpoſed as the ordinary blood-veins, and becauſe the fluid which they contain, runs from ſmaller into larger tubes or veſſels. The lacteal veins are long ſlender pipes whoſe coats are ſo thin as to become inviſible when they are not diſtended with chyle. They ariſe from all the parts of the ſmall guts, by a vaſt number of fine capillary pellucid tubes, which, as they run from the ſides of the inteſtines to the glands in the meſentery, frequently unite, and form fewer and larger branches (called venæ lacteæ primi generis) which paſs through the glands of the meſentery; and from theſe ariſe, other lacteals of a larger ſize (named lactea ſecundi generis) which carry the chyle immediately into the receptaculum chyli. The mouths of theſe lacteals, which are open into the cavity of the guts, from whence they receive the chyle, are ſo ſmall as not to be ſeen by the beſt microſcope. It was neceſſary they ſhould be ſmaller than the fineſt arteries in the body, that nothing might enter which could ſtop the circulation of the blood. The ſame extremity of the lacteals has, likewiſe, communication with the capillary arteries of the guts, by which they receive a lymph that dilutes and propels the chyle forwards, and waſhes the lacteals and glands, that they may not be obſtructed by the chyle's ſtaying in them upon faſting. The other extremity of the lacteals diſcharges the chyle into the veſicular cells of the meſenteric glands, &c. as before mentioned. The lacteal veins have valves at certain diſtances, which hinder the chyle from returning back into the inteſtines.

The office of theſe veins is to receive the fluid part of the digeſted aliment, which is called chyle, and convey it to the receptaculum chyli, that it may be thence carried through the ductus thoracicus into the blood-veſſels.

Receptaculum chyli.

Receptaculum chyli is a membranous ſomewhat pyriform bag, two thirds of an inch long, one third of an inch over in its largeſt part, when collapſed; ſituated on the firſt vertebra lumborum, to the right of the aorta, a little higher than the arteria emulgens dextra, under the right inferior muſcle of the diaphragm. It is formed by the union of three tubes; one, from under the aorta, the ſecond, from the interſtice of the aorta and cava, the third, from under the emulgents of the right ſide. It lies between the deſcending trunk of the aorta and the above vertebræ, and is biggeſt between the cæliac and emulgent arteries, ſurrounded by veſicular glands, called glandulæ lumbares, which diſcharge their lymph into it. The receptacle receives all the ſecond order of the lacteals, as well as all the lymphatic veins, both of the legs, and of all the parts of the abdomen. This ſaccus chyliferus will contain about one ounce of water; at its ſuperior part becoming gradually ſmaller, it is contracted into a ſlender membranous pipe of about a line diameter, well known by the name of ductus thoracicus; this paſſes betwixt the appendices muſculoſæ diaphragmatis, on the right of, and ſomewhat behind the aorta, then lodged in the cellular ſubſtance under the pleura; it mounts between this artery and vena ſine pari, or azygos, as far as the fifth vertebra thoracis, where

Ductus thoracicus.

where it is hid by the azygos, as this vein riſes forward to join the cava deſcendens; after which the duct paſſes obliquely over to the left ſide under the oeſphagus, aorta deſcendens, and great curvature of the aorta, until it reaches the left carotid, ſtretching farther towards the left internal jugular, by a circular turn, whoſe convex part is uppermoſt; at the top of this arch it ſplits into two, for one half line, the ſuperior branch receiving into it a large lymphatic from the cervical gland. This lymphatic appears, by blowing and injections, to have two valves; when the two branches are united, the duct continues its courſe to the internal jugular, behind which it deſcends, and immediately at the left ſide of the inſertion of this vein, enters the ſuperior and poſterior part of the left ſubclavian, whoſe internal membrane duplicated forms a ſemilunar externally convex valve that covers two thirds of the orifice of the duct; immediately below this orifice a cervical vein from the muſculi ſcaleni enters the ſubclavian. The ductus thoracicus has a thin coat, and valves at ſeveral diſtances (commonly ten or twelve), which hinder the chyle, that has once paſſed them, from falling back. The diameter of the duct varies in moſt bodies; and in the ſame ſubject is uniform, but frequently ſudden enlargements or ſacculi of it are obſervable. The diviſions which authors mention of this duct within the thorax are very uncertain; as is the preciſe vertebra where it begins to turn towards the left. Frequently it does not ſplit at its ſuperior arch, in which caſe a large ſaccus is found near its aperture into the ſubclavian vein. Generally it has but one orifice, though I have ſeen two in one body, and three in another; nay, ſometimes it divides into two under the curvature of the great artery, one going to the right, another to the left ſubclavian; this however is very rare. The lymphatic, which enters the ſuperior arch, is often ſent from the thyroide gland. The thoraic duct receives the lymphæducts from the ſeveral parts of the thorax, as it paſſes along to the ſubclavian vein. By its running up to the left ſide, the chyle receives a new impetus from the pulſation of the aorta; whereas, on the right ſide, it muſt have aſcended only by the preſſure of the diaphragm, and the muſcles of the lower belly upon the receptacle, which it equally enjoys in its preſent ſituation.

The receptaculum chyli is eaſily found in living bodies, but with greater difficulty in thoſe that are dead.

SECT. X.

Of the GLANDS in general.

A Gland is a ſmall body, formed by the interweaving of veſſels of every kind, covered with a membrane, uſually provided with an excretory duct, and deſtined to ſeparate ſome particular fluid from the maſs of blood, or to perfect the lymph. Gland, what.

Glands are parts of a peculiar ſtructure; they are of various figures, colours, and conſiſtencies, as they are deſtined to different offices: a definition, or even a general character of which, (that ſhall include all the true glands, and take in no other parts of the body with them) is exceedingly difficult. Many writers on this ſubject have aſſerted, that wherever there is a ſecretion of any kind performed there is a gland, but this is not true; for there are many ſecretions performed in the body, and thoſe even of the largeſt and moſt important kind, where there are no glands to perform them: the chyle is ſecreted in the inteſtines without the aſſiſtance of glands; the ſemen is ſecreted in the teſticles; and the pituita, in the pituitary ſinuſſes of the brain, where there are no glands at all. On the other hand alſo it is to be obſerved, that there are glands received and allowed by all writers as ſuch, which do not appear to perform any ſecretions at all. Mery, in the Memoirs of the Royal Academy at Paris, not only proves that all the ſecretions are not performed by means of glands, but that many of the ſecretions of moſt importance to the body, are performed without glands. It is evident, that the ancients called certain parts of the human body glands, and that for no other reaſon, but becauſe they found them compoſed of a peculiar kind of fleſhy ſubſtance, of a peculiar habit, or external appearance, without paying the leaſt regard either to their internal ſtructure, their ſpherical figure (by which character ſome define them) or their uſe. " If it be aſked, ſays Heiſter, what this peculiar habit in the gland is? or how we are to know it? the anſwer is, that the peculiar complication and arrangement of the veſſels, from which there ariſes a form obviouſly diſtinguiſhable at ſight from the muſcles, the fat, the bones, the membranes,

branes, the veſſels, and in fine, from every other part of the human ſtructure, which gives a ſufficiently certain, determinate, and ſtriking notice of it."

The kinds of glands, according to many authors, are very numerous; but I ſhall firſt divide them only into two general kinds, viz. the ſimple, called conglobate glands; and the compound, named conglomerate glands. **Kinds of.**

The conglobate gland is a little ſmooth body, wrapt up in a fine ſkin or membrane, by which it is ſeparated from all other parts, only admitting an artery, and a nerve to paſs in, and giving way to a vein and excretory canal, or duct, to come out, of which ſort are the glands of the brain and teſtes. Winſlow includes, under the name of conglobate glands, the lymphatic glands alone, and calls all the other glands of the body by the name of conglomerate. **Conglobate glands.**

The conglomerate gland is that which is compoſed of ſeveral little conglobate glands, all tied up together in one common tunicle or membrane. Sometimes all their excretory ducts unite, and make one common pipe, through which the liquor of them all runs, as the pancreas and parotides do. **Conglomerate glands.**

Sometimes the ducts uniting, form ſeveral pipes, which only communicate with one another by croſs canals; and ſuch are the mammæ: others again have ſeveral pipes, without any communication with one another; of which ſort are the glandulæ lachrymales, and proſtatæ; and a fourth ſort is when each little gland has its own excretory duct, through which it tranſmits its liquor to a common baſon, as the kidneys.

Confiſtence of glands. The glands differ greatly in regard to their conſiſtence; ſome of them are conſiderably hard and firm, and others extremely ſoft and tender: of the latter kind, in particular, are the glands ſituated in the articulations of the bones of the ſeveral parts of the body. They differ alſo very conſiderably in colour; ſome of them are of a pale whitiſh red, or fleſhy colour; others of a ſtrong, deep red; others yellowiſh, or browniſh; and ſome evidently blackiſh.

Colour of glands.

Figure of the glands. Their differences in figure are as conſiderable as in colour; ſome of them are round, others oval, others oblong, and many others of figures as different as they poſſibly can be, from any of thoſe regular ones: the pancreas, the thyroide, and the thymus, are inſtances of this. Some of them have obtained their names from their peculiar figure; of this number are the glandula pinealis, the miliares, and others.

Uſes of the glands. The uſes of the glands are alſo as different as their colours or figures; ſome of them are ſalival, mucoſe, and lymphatic; others are mucilaginous, ſebaceous, and waxy; others, lachrymal, pituitary, &c. and from theſe their ſeveral contents or ſecretions, they are termed lachrymal, &c.

Situation of the glands. The ſituation of the glands is another article in which they differ, and from which many of them have their ſeveral names; ſuch are the parotides, maxillares, linguales, thyroide, palatine, labial, jugular, cervical, axillary, inguinal, lumbary, inteſtinal, meſenteric, renal, &c. Finally, the ſize of the glands is a thing in which they differ moſt obviouſly and eſſentially. The glands in particular will be treated of in their proper places hereafter.

SECT. II.

Of the MEMBRANES in general.

Membrane deſcribed.

A Membrane is a pliable texture of fibres interwoven together in the ſame plane. The membranes differ in thickneſs, according to the ſmallneſs of their fibres, or the number of their planes: theſe planes are termed laminæ, and are diſtinguiſhed into internal, external, and middle. The difference of membranes, in general, depends on that of the fibres of which they are compoſed; ſmall portions of membranes, eſpecially when they are very thin, are called pellicles; and ſome membranaceous laminæ are united together by the intervention of a particular ſubſtance, compoſed of this ſort of pellicles, and called the cellular or ſpongy ſubſtance. Every diſtinct part of the body is covered, and every cavity is lined with a ſingle membrane, whoſe thickneſs and ſtrength is as the bulk of the part it belongs to, and as the friction to which it is naturally expoſed.

Names.

The membranes of the body are various, and variouſly denominated; ſuch are the peritonæum, pericardium, pleura, pericranium, dura mater, pia mater, &c. Thoſe which ſerve as integuments, or covers of veſſels, are called tunics or coats; and thoſe which cover the brain, are called meninges, &c. The muſcles too, are each incloſed in a peculiar membrane.

The uſe of the membranes is to cover and wrap up the parts, ſtrengthen them, and ſave them from external injuries; thoſe that contain diſtinct parts, keep the parts they contain together, and render their ſurfaces ſmooth, and leſs ſubject to be lacerated by the actions of the body; and thoſe which line cavities ſerve to render the cavities ſmooth and fit for the parts they contain to move againſt. The membranes are not only of uſe to join one part to another, but alſo to preſerve the natural heat, to ſuſtain ſmall veſſels, and the nerves, which run through their duplicatures; to ſtop the returning of the humours in their veſſels, (as the valves ſtop the returning of the blood in the veins and heart,) of the chyle in the thoracic duct, and of the lymph in the lymphatic veſſels. The membranes of all the cavities that contain ſolid parts, are ſtudded with glands, or are provided with veſſels, which ſeparate a mucus to make the parts contained move ſmoothly againſt one another, and not grow together; and thoſe cavities which are expoſed to the air, as the noſe, ears, mouth, and the trachea arteria, have their membranes beſet with glands which ſeparate matter to defend them from the outer air. Thoſe membranes that have proper names, and deſerve a particular deſcription, will be treated of in their proper places.

CHAP. II.

SECT I.

Of the HEAD and its PARTS.

THE ſuperior cavity of the body is the head; the hair of it is termed capillus (which, according to the rectitude or obliquity of the pores, hangs either ſtrait or crooked); that part which is covered with hair, is termed the ſcalp; the crown of the head, vertex; the hinder part, occiput; the forepart, ſinciput; that part between the hair and the eye-brows, frons, the forehead; the ſides of it, tempora, the temples; the eye-brows, ſupercilia; the ſpace between the eye-brows, glabella; the eye-lids (both upper and lower) palpebræ ſuperior et inferior, and the cartilaginous edges of both, with the hairs growing thereon, are termed cilia; the hollow of the eye, cavum occuli; the inner angle of the eye canthus major, the outer corner of it, canthus minor; and the eye, occulus, which conſiſts of proper tunicles and humours. Head, Parts of. Eye.

The ridge of the noſe is termed ſpina naſi; the tip of the noſe, orbiculus vel globulus naſi; the noſtrils, nares; the partition between them, ſeptum naſi; the ſides of the noſtrils, alæ; the hairs growing within, vibriſæ. Internally, the maxillary, ſphenoidal, and frontal ſinuſes. Noſe.

The outer ear is termed auricula, but more properly auris externa. In this there are a great Ear.

great many eminences and cavities; the upper part is termed pinna; the lower part, lobus or fibra; the outer circle, helix; the inner circle (or ſemicircle), antihelix; the ſpace between the two circles, ſcapha; the lower end of the antihelix, or ſemicircle, makes a little prominence, which is called antitragus, becauſe there is another prominence juſt oppoſite to it, called tragus; the cavity made by the extremity of the helix is called concha; the hollow in the middle of the ear is termed alvearium, and has a hole or paſſage into the internal ear, named meatus auditorius. See chap. viii. Of the Ear.

Mouth. The upper jaw is termed maxilla ſuperior; the prominent part of the cheek, mala; the lower jaw, maxilla inferior; the hollow, or cheeks ſtretched out in blowing, bucca; the chin, mentum; the beard, or place where it grows on the upper lip, myſtax; the gutter in the middle under the noſe, is philtrum. The external parts of the mouth are the lips, one upper, and the other under; the internal parts are the gums, termed gingivæ; the teeth, dentes; the tongue, lingua; the roof of the mouth, palatum; with the uvula there ſuſpended for modulating the voice, &c.

The other internal parts of the eye, noſe, ear, and mouth, ſuch as the glands, membranes, muſcles, &c. muſt be referred to the particular deſcriptions of theſe parts.

SECT. II.

Of the BONES of the HEAD.

THE bones of the cranium which contain the brain, to defend it from external injuries, are properly but eight, though if we reckon the oſſa petroſa diſtinctly from the oſſa temporum they are ten.

Bones of the cranium.

The os frontis is a bone of an irregular form, ſituated in the anterior part of the ſkull, and forms that part of the face which is called the forehead, from whence it has its name. Its figure is ſymmetrical, reſembling a large ſhell, almoſt round; it is joined by ſuture to the oſſa parietalia, ungues vel lachrymalia naſi, maxillaria, malarum, os æthmoides et ſphenoides.

Os frontis.

The os frontis contains the anterior lobes of the brain, and a portion of the longitudinal ſinus, and forms the forehead; its lower parts compoſe the upper parts of the orbits of the eyes; on its internal ſurface are impreſſed the volvuli of the brain, which uneveneſs helps to keep the anterior part of the brain ſteady. In its middle above the os æthmoides, uſually ariſes a thin ſpine, which ſtrengthens that part of the bone, which would otherwiſe be weak from its flatneſs, but in ſome ſkulls this ſpine is wanting, and then the bone is generally thicker in that place: to this ſpine the longitudinal ſinus of the dura mater adheres. From the middle of the os frontis externally, goes a proceſs which ſupports the bones of the noſe. Immediately above the os æthmoides, in this bone, is a ſmall blind hole, through which runs a vein into the beginning of the longitudinal ſinus of the dura mater; and on the upper edge of each orbit is a ſmall perforation or a notch, through which nerves and an artery paſs ſecure to the forehead; it has alſo a ſmall hole in each orbit, near the os planum, through which paſſes a branch of the fifth pair of nerves.

In the ſubſtance of this bone near the noſe are two, three, four, and ſometimes five ſinuſes, which open into the noſe; they differ greatly in different ſubjects, and are but ſeldom found in children. Theſe ſinuſes, and the ſpine in this bone, make it very dangerous if not impracticable, to apply a trephine on the middle and lower part of the forehead.

Oſſa Parietalia.

Oſſa parietalia (by ſome, termed bregmatri, or ſincipitis) are two bones larger than any other in the ſkull, of which they compoſe the ſuperior and lateral parts, and to which the temporal muſcles are partly fixed: internally, theſe bones are remarkably imprinted by the arteries of the dura mater, and beſides theſe there are other foveæ.

Oſſa temporum.

Oſſa temporum, vel ſquamoſa, are two bones ſituated below the parietal bones, at the middle and lower parts of the ſides of the ſkull; they have each at their back parts one large ſpongy proceſs called mammillaris, or maſtoideus; and from the lower and middle parts of each, a proceſs which joins the oſſa malarum, named jugalis or zygomaticus: there is alſo an exterior ſinus lined with a cartilage which receives the proceſs of the lower jaw.

The oſſa petroſa lie between the former and the occipital bones, or are truly portions of the temporal bones, being never found ſeparate in adult bodies. They have each on their outſides one long ſlender proceſs called ſtyliformis, and near the ſide of this proceſs a foramen, which runs obliquely forwards into the ſkull, through which the carotid arteries paſs to the brain; theſe are the ſixth foramen, and one in the inſide of the ſkull, leading to the organs of hearing is the ſeventh. The ridge on the upper parts of each of theſe bones alſo helps to keep the brain ſteady, and greatly ſtrengthens this bone, which would otherwiſe be exceeding weak. There is likewiſe an internal proceſs properly called the os petroſum; this is pretty long and large, containing the whole meatus auditorius and cavity of the tympanum, of which more hereafter. Oſſa petroſa.

The os occipitis makes all the back part of the ſkull; it is bounded by the ſphenoidal, temporal, petroſal, and parietal bones; it has two ſmall apophyſes, by which it is articulated to the ſpine; near thoſe apophyſes are two ſmall foramina, which are the ninth of the ſkull; through theſe paſs the ninth pair of nerves; and between theſe is the great, or tenth foramen, through which the medulla oblongata deſcends into the ſpine, the cervical arteries enter, and the cervical veins paſs out. In the inſide of this bone is a crucial ſpine impreſſed by the longitudinal and lateral ſinuſes; and on the outſide oppoſite to the middle of this ſpine, in ſome bodies, is an apophyſis, and from that, down to the great foramen, a ſmall thin ſpine. The ſpines in this bone are for ſtrength as thoſe be- Os occipitis.

before mentioned. The thinner parts of this bone are alſo defended by the muſcles that cover them; which proviſion is very neceſſary becauſe we can leaſt defend this part, and blows here are of worſe conſequence than on any other part of the ſkull, becauſe wounds in the cerebellum which is underneath, are mortal. There are in moſt ſkulls a foramen behind each apophyſis of the occipital bone, through which paſs ſinuſes, from the lateral ſinuſes to the external cervical veins. By means of theſe, as in all other communications of the ſinuſes, the blood paſſes from thoſe that happen to be ſurcharged by any poſture of the head, into thoſe that from the ſame poſture would have been almoſt empty. Such ſkulls as want theſe foramina, have two ſinuſes for the ſame purpoſe.

Os æthmoides.

The os æthmoides vel cribriforme is a ſmall bone, about two inches in circumference, ſituated internally in the fore-part of the baſis of the ſkull, and almoſt ſurrounded by the os frontis. It is full of holes like a ſieve; it is a principal part of the organ of ſmelling, and gives a very great extent to the pituitary membrane in a ſmall compaſs. The greater part of the laminæ ſpongioſæ in the noſe belong to this bone. In the middle of this bone ariſes a large proceſs named criſta galli; and oppoſite to this a thin one, which in part divides the noſe.

Os ſphenoides.

The os ſphenoides is of a very irregular figure, ſeated in the middle of the baſis of the ſkull, fixed in manner of a wedge among the other bones of the cranium, viz. the os frontis, æthmoides, vomer, occipitis, maxillæ ſuperioris, oſſa parietalia, palati,

lati, malarum, temporum, and petroſa; the latter, as before obſerved, are parts of the temporal bones. In its inſide next the brain is a cavity named ſella turcica vel equina, which is bounded by four proceſſes called clinoides; under the two foremoſt of which, paſs the internal carotid arteries, and from their outſides are continued two thin long proceſſes, upon that part of the frontal bone which ſeparates the anterior lobes of the brain from the poſterior; oppoſite to the ſella turcica is a proceſs which makes part of the ſeptum narium.

On the outſide of the ſkull adjoining to the upper jaw, are two proceſſes of this bone on each ſide, named pterygoides, from which ariſe one on each ſide near the palate which have no name. Over theſe paſs the tendons of the pterygoſtaphylini externi muſcles; nearer towards the occiput, between theſe and the ſtyloide proceſſes of the oſſa petroſa, ariſe two more ſmall rugged proceſſes; and under the ſella turcica vel equina in this bone, is a ſinus called the ſphenoidal ſinus, which is ſometimes double and opens into the noſtrils; but ſometimes it is totally wanting, eſpecially in children, where only ſuch a ſubſtance is ſeen, as is found in the ends of ſome of the bones: this ſinus belongs properly to the os æthmoides. At the inſide of the baſis of the two anterior clinoid proceſſes are two round holes, which are the firſt foramina of the ſkull; through theſe the optic nerves paſs; almoſt under theſe towards the ſides of the ſkull, are two irregular ſlits, named foramina lacera, or the ſecond foramina of the ſkull, through which paſs nerves and blood-veſſels into the orbits of the eyes; and under theſe, towards the occiput, are two round holes, which are the third foramina, through which paſs nerves to the face; about half an inch nearer the occiput are two more of an oval figure, which are the fourth foramina, through which paſs the largeſt branches of the fifth pair of nerves; and a ſtraw's breadth farther, two very ſmall ones called the fifth foramina, through which thoſe branches of the carotid arteries enter that are beſtowed upon the dura mater.

Between this laſt deſcribed bone and the oſſa petroſa, are two large rough holes, in which there is ſometimes obſerved large veins; and from theſe holes, through part of the os ſphenoides, under the pterygoid proceſſes are ſmall holes, through which paſs arteries to the back part of the noſe. For a more particular account of the foramina of the cranium, ſee the next ſection: as alſo for the ſutures which join the bones of the ſkull.

Shape of the ſkull, &c.

The ſhape of the ſkull (being flatted on the ſides, and prominent behind) contributes to the enlargement of the ſight and hearing: it is of unequal thickneſs in the ſeveral parts, and is compoſed of two lamellæ or tables, an exterior and an interior, laid over each other, between which there is a diploe or meditullium, being a thin ſpongious ſubſtance made of bony fibres detached from each lamina, and full of little cells of different dimenſions. The tables are hard and ſolid, the fibres being cloſe to one another. The diploe is ſoft, the bony fibres being here at a greater diſtance; a contrivance (of the all wiſe Creator's) whereby

Tables.

Diploe.

whereby the ſkull is not only made lighter, but leſs liable to fractures.

Pericranium. The external lamina of the cranium is ſmooth and covered with the pericranium, which in other bones is called by the general name of perioſteum, becauſe of its adhering to the bone. It being a thick ſolid coat or membrane, ſome divide it into two membranes, the under one whereof immediately inveſting the ſkull they call perioſteum, and the upper pericranium. In effect it is one double membrane, conſiſting, as moſt others do, of two coats. It is ſuppoſed by ſome to have its origin from the dura mater, which paſſing through the ſutures of the ſkull, by means of ſeveral filaments, forms this thick membrane; at leaſt it is found connected to the dura mater, by fibres tranſmitted from it to the membrane through the ſutures. About the origin of the temporal muſcles, the coats of the pericranium part; the outer, paſſing over thoſe muſcles, and the inner, ſtill adhering cloſe to the cranium.

The internal lamina of the cranium is likewiſe ſmooth, except the furrows made by the pulſation of the arteries of the dura mater before the cranium be arrived at its conſiſtence.

All the bones of the cranium are found to be imperfect in new born infants; the ſinus, and its meditullium, are almoſt wholly wanting; the bony fibres in the formation of almoſt all of them, (as before obſerved in treating of the bones in general,) are carried in form of rays from a centre towards the circumference.

Bones of the Face, &c. The bones of the face, &c. are the oſſa naſi, malarum, ungues, plana, maxilla ſuperior palati, os vomer, ſpongioſum, maxilla inferior; to which may be added, the bones of the ear and tongue.

Oſſa naſi. The oſſa naſi make the upper part of the noſe; they form that kind of arch which is fitteſt to ſuſtain ſuch injuries as the noſe is moſt expoſed to.

Oſſa malarum. Oſſa malarum are two bones ſituated in the lateral and middle parts of the face; theſe bones make the prominent upper part of the cheeks moſt remarkable in lean perſons: they form likewiſe the anterior, lower, and outer parts of the orbits of the eyes; they have each a ſhort proceſs, which proceſſes join the proceſſus jugales of the temporal bones, and form arches which have been called oſſa jugalia vel zygomaticus.

Oſſa ungues. The oſſa ungues vel lachrymalia are two in number, each being ſituated in the orbits of the eyes towards the noſe; they are the leaſt bones of the face, very thin and tranſparent: between each of them and the upper jaw is a foramen as large as a gooſe quill, into which the puncta lachrymalia lead, to carry off any ſuperfluous moiſture from the eyes into the noſe.

Oſſa plana. The oſſa plana are ſeated immediately beyond the foregoing bones, in the orbits of the eyes, and are near thrice as big; they are rather ſmooth ſurfaces of the os ſpongioſum, than diſtinct bones, and are very often imperfect.

Maxilla Superior. The maxilla ſuperior, or upper jaw, tho' generally deſcribed ſingle, conſiſts of two bones, being manifeſtly divided by a ſuture, which is ſcarce ever obliterated; they are ſituated one on each ſide, in the anterior middle part of the face. It has two proceſſes which join the os frontis, and make part of the noſe, and another, which joins to the cartilage of the ſeptum naſi. Its upper and outward parts make the lower parts of the orbits of the eyes; its lower ſide, all that part of the face under the cheeks, eyes, and noſe, to the mouth, and two thirds of the roof of the mouth.

A little below the orbits of the eyes, in this bone, are two holes, and behind the dentes inciſores one more, which divides into two, as it opens into the noſe, on each ſide the ſeptum naſi. Between the poſterior grinding-teeth and the orbits of the eyes, are two great ſinuſes called antra maxillæ ſuperioris, which open into the upper part of the noſe; and in the lower edge of this jaw are the alveoli, or ſockets for the teeth. Part of the ſides of theſe cavities that lie next the noſe, are only membranes, which make the cavities like drums; perhaps to give a grave ſound to the voice when we let part of it through the noſe. Impoſtumations ſometimes happen in theſe cavities: the ſigns of this diſeaſe are great pain about the part, matter in the noſe on the ſide diſeaſed, ſtinking breath, and rotten teeth. The cure is performed by drawing out the laſt tooth but one, or drawing two or more if rotten; and through their ſockets making a perforation into the antrum, which ſometimes happens from drawing a tooth, and, perhaps gave Dr. Cowper the firſt hint of this cure; then that opening muſt be enlarged, if it is not ſufficient to diſcharge the matter.

The oſſa palati are two ſmall bones that make the back part of the arch of the palate or roof of the mouth; they are ſituated be- Oſſa palati.

tween the pterygoide apophyſis, and the oſſa maxillaria, and running up on the ſides of the naſal foſſæ, form a ſmall part of the bottom of each orbit of the eyes. Between the oſſa palati and the os maxillare near the pterygoide proceſſes of the ſphenoidal bone, are two ſmall foramina, through which arteries and nerves paſs to the palate.

Os vomer. The os vomer is ſituated between the bones of the palate and the ſphenoidal bone; it is alſo joined to the proceſs of the æthmoides, and part of the lower jaw: its forepart is ſpongy, and is continued to the middle cartilage of the noſe; the vomer is thus placed perpendicular between the two naſal foſſæ, which with its cartilage are the ſeptum naſi.

Os ſpongioſum. The os ſpongioſum is by ſome treated as a diſtinct bone, though it is only the ſpongy laminæ in the noſe, of the os æthmoides and oſſa plana, but chiefly of the former, to which it always adheres.

Maxilla inferior. The maxilla inferior or lower jaw, is but one bone in adults, but in children two, which unite in the middle of the chin, by the intervention of a cartilage, which, as the child grows, hardens into bone; in children it alſo conſiſts of two tables and a diploe between. This bone is articulated with looſe cartilages to the temporal bones, by two proceſſes named condyloides*;* near theſe ariſe two more, called coronales, and at the inſide of the chin a ſmall rough proceſſus inominatus. In the inſide of this bone, under each proceſſus coronalis, is a large foramen which runs under the teeth, and paſſes out near the chin; in this foramen, the veſſels paſs that belong to the teeth; and in the upper edge of the jaw are the ſockets for the teeth.

Dentes. The teeth are the hardeſt, moſt ſolid, and whiteſt parts of the whole ſkeleton; the number in adults, if perfect, is generally thirty-two (ſixteen in each jaw); the four fore-teeth in each jaw, are called inciſiores; the next (one on each ſide the inciſores) canini, called by ſome the eye-teeth; the reſt are the molares or grinders, the laſt of which (on each ſide) above and below, are termed dentes ſapientiæ, becauſe they do not appear, till men arrive at the years of diſcretion.

The inciſores and canini have only one ſingle root; the two firſt of the molares on each ſide have two roots, and the reſt ſome three, ſome four, eſpecially in the upper jaw, where alſo they are ſpread wider, becauſe that jaw being more ſpongy than the other, the teeth need more ſpace to fix them. The cavities of the teeth are covered or lined with a fine vaſculo-nervous membrane; and each branch of the roots have a foramen or hole at their bottom, through which paſs an artery, vein, and nerve to afford them nutrition and ſenſation; theſe veſſels and membrane are the ſeat of the tooth-ach. The teeth of children caſt off while they are growing, but the ſucceeding teeth ariſe in new ſockets, deeper and larger than the former; for the jaws increaſing faſter than the teeth, muſt otherwiſe have left chaſms between them, ſuch as are in the mouths of brutes: but where teeth are drawn in adults, the ſockets cloſe, and new ones very rarely ſucceed.

Os hyoides. The os hyoides, or bone of the tongue, is ſituated in the middle ſpace, between the angles of the lower jaw; and adheres to the baſe of the tongue.

In moſt ſubjects, the os hyoides is compoſed of five bones, viz. a baſe, occupying its middle part, two lateral ones called its horns, and at the juncture of theſe with the baſe, two other fruſtræ very ſmall, and thence overlooked by moſt writers: theſe are nearly of the ſhape of a wheat corn, and may therefore be termed oſſa triticea. There are ligaments fixed to theſe, by means of which they adhere to the ſtyloide proceſſes; and finally, in theſe ligaments themſelves, ſometimes, though very rarely, there are found ſome other little bones. Veſalius met with ſix of theſe, and ſome others ſince, mention eleven.

The uſe of the os hyoides is to give a firm baſis to the tongue; and therefore ſeveral muſcles of the tongue and larynx, ſerving to the neceſſary motions of both, are inſerted in it.

Bones of the internal ear.

The bony cavity of the tympanum contains ſeveral little bones, called the bones of the ear, which take their names from the things they are thought to reſemble, viz. malleus, incus, ſtapes, and orbiculare, but this laſt in dried bones, paſſes ſometimes unobſerved.

Malleus.

Malleus, or the hammer, is a ſmall long bone with a large head, a ſmall neck and handle, and two apophyſes, one in the neck, the other in the handle; the manubrium, or handle, adheres to the membrane of the tympanum, and its head is articulated by a ginglymus with the body of the incus.

Incus.

The incus, or the anvil, reſembles in ſome meaſure, one of the anterior dentes molares, with its roots at a great diſtance from each other; at leaſt it is more like this than an anvil. We are chiefly to obſerve its body, its fovea or hollow (ſerving for its articulation with the malleus) and its two crura or legs.

The body is turned forward, the ſhort leg backward, and the long leg downward, which laſt is articulated, by arthrodia, with the head of the ſtapes.

Stapes.

The ſtapes, or the ſtirrup, is a little bone ſituated in the cavity of the feneſtra ovalis. The head of this bone is joined to the longer leg of the incus; its baſis adheres (by means of a membrane) to the feneſtra ovalis of the labyrinth of the ear; its two lateral parts have their internal ſurface furrowed; the head is articulated by arthrodia with the leg of the incus.

Os orbiculare.

The os orbiculare, the orbicular or lenticular bone, is the ſmalleſt bone in the body; it lies between the head of the ſtapes and extremity of the long leg of the incus, being articulated with each of theſe.

SECT. III.

Of the SUTURES and FORAMINA of the CRANIUM.

Sutures of the cranium.

IN adults, the ſeveral bones of the cranium (before mentioned) are in general joined by ſutures; theſe ſutures are either common or proper; the proper ſutures are diſtinguiſhed into the true, and the falſe or ſpurious.

True ſutures.

They are called true ſutures when the bones are joined together by means of a multitude of unequal denticulated eminences, forming an appearance ſomewhat like the edge of a ſaw; theſe denticulations enter mutually into each others ſinuſes, and on the outſide are moſt plainly viſible: of this kind are the coronal, ſagittal, and lamboidal ſutures.

Spurious ſutures.

The falſe or ſpurious ſutures are thoſe ſquamoſe ones of the temporal and parietal bones, and of the os frontis and ſphenoides, in the angle where they unite with the parietals. The common ſutures are the tranſverſal one, which joins the os frontis with the bones below it, the os ſphenoides, æthmoides, zygomaticus vel jugale; but theſe are of little moment. Between the ſutures, particularly the lamboidal and ſagittal, there are found in many ſkulls certain ſmall bones, which are called by ſome oſſa triquetra, from their figure; by others oſſa Wormiana: they are uncertain in their figures and ſituation, and are joined to the other bones by ſutures.

Sutura coronalis.

The ſutura coronalis runs acroſs the ſkull, from one upper edge of the ſphenoidal bone to the other, and joins the parietal bones to the frontal.

Sutura ſagittalis.

The ſutura ſagittalis joins the parietal bones; beginning at the os occipitis, and is continued to the os frontis, in children down to the noſe; the os frontis in them being two bones, and ſometimes ſo in adult bodies.

Sutura lamboidalis.

The ſutura lamboidalis joins the back part of the oſſa bregmatis or parietal bones, to the upper part of the occipital.

Sutura ſquamoſa.

The ſutura ſquamoſa is made by the upper part of the temporal and ſphenoidal bones wrapping over the lower edges of the parietal bones.

The

Sutura tranſverſalis.

The ſutura tranſverſalis runs acroſs the face, through the bottoms of the orbits of the eyes; it joins the lower edge of the frontal bone to the os ſphenoides, maxillæ ſuperioris, oſſa naſi, ungues, palati, and jugalia or malarum.

Uſe of the ſutures.

The ſkull being thus divided by its ſutures into many bones, is neither ſo ſubject to fractures, nor to have fractures ſo far extended, as it would have been were it compoſed of one bone only. This ſtructure of the ſutures is alſo of uſe to join the dura mater very firmly to the cranium and pericranium in thoſe parts; and for the oſſification of the bones; and in infants that the head may the more eaſily be extended in its growth from the ſeveral bones, being at that period diſunited at theſe places; and alſo for the birth, becauſe theſe bones not being perfect at that time, may be preſſed together, and make the head leſs. There is alſo another advantage in their openneſs in children, namely, that medicinal applications to the external part of the head may penetrate and do ſervice: and finally, that the tranſpiration from the brain may be the more free and eaſy at that time of life in which the bones are open, and in which alſo the habit is more humid.

Foramina of the ſkull.

The ſkull has ſeveral foramina or holes, through which it gives paſſage to the ſpinal marrow, nerves, arteries and veins, for the conveyance of the blood, &c. between the heart and brain.

Diviſion of.

The foramina in the cranium are numerous, and their uſes important; theſe are divided into the external and internal; by the external, are meant thoſe which are eaſily diſcovered on the external ſurface of the ſkull; and by the internal are meant thoſe which are moſt obvious in the internal ſurface.

Internal foramina.

Of the larger internal foramina there are eleven pair, affording paſſage to the arteries, veins, and nerves of the brain; beſides theſe, there is one that is ſingle, viz. the great foramen of the occipital bones, that gives paſſage to the medulla ſpinalis and with it to the acceſſory ſpinal nerves and to the vertebral arteries. Particular regard is to be had to the firſt pair of thoſe foramina (which may indeed be properly called a congeries of the foramina of the os æthmoides;) theſe give paſſage to the filaments of the firſt pair of nerves, called the olfactory nerves; the ſecond pair are in the ſphenoidal bones and give paſſage to the optic nerves; the third pair are called the unequal and lacerated foramina, and give paſſage to the third and fourth pair of nerves, to the firſt branch of the fifth pair, and to the ſixth pair, as alſo to the emiſſary of the receptacles of the dura mater; the fourth pair are in the ſphenoidal bone, and give paſſage to the ſecond branch of the fifth pair of nerves, which is diſtributed to the ſeveral parts of the upper jaw; the fifth, or oval foramina, give paſſage to the third branch of the fifth pair of nerves, and to the emiſſary of the dura mater; the ſixth is a very ſmall foramen, and admits of an artery which is diſtributed over the dura mater, and is that which forms the tree-like impreſſions on the inſide of the parietal bones; the ſeventh is placed between the ſella equina and the petroſe apophyſis, and it tranſmits no veſſels, but is ſhut up by the dura mater;

ter; the eighth pair of foramina give paſſage to the carotid arteries, whence it is called the carotic foramen, and the intercoſtal nerve has its egreſs alſo at this opening; through the ninth, which is in the os petroſum, paſſes the auditory nerves; through the tenth, which is between the os petroſum and the occipital bone, paſs the par vagum and the lateral ſinuſes of the dura mater, together with the ſpinal nerve. The eleventh is in the os occipitis, near the edge of the foramen magnum, and through this paſs the ninth pair of nerves, called the linguale.

Beſides theſe foramina there are a number of little ones in the os petroſum, often very viſible; one of theſe carries back a branch of the auditory nerve to the dura mater, and the other principal one tranſmits the ſanguiferous veſſels to the labyrinth or the internal organ of hearing.

External foramina.

Of the external foramina there are two proper ones of the os frontis, a little above the orbits; theſe are from their ſituation called ſupra orbitalia; they give paſſage to the opthalmic nerve of Willis. Beſides theſe there are four other foramina common to the os frontis, and to the plane, or papyraceous bones of the orbit; two of theſe are placed on each ſide, and they tranſmit little nerves and veſſels to the ſinus of the os æthmoides. In the parietal bone there is one which ſerves for the paſſage of a vein from the cutis of the cranium into the ſagittal ſinus of the dura mater, or from the ſagittal ſinus to the external veins of the head; but this is often wanting. In each of the oſſa temporum there are three common foramina, the firſt of theſe is the foramen jugale, which ſerves for the paſſage of the temporal muſcle; the ſecond is large, in which is the ſinus of the jugular vein; and the third is the ductus Euſtachii, ſituated between the petroſum and the ſphenoides, and leading from the mouth into the internal ear. Beſides theſe common foramina of the oſſa temporum, there are alſo three proper ones: 1. the meatus auditorius; 2. the aquæduct of Fallopius, ſituated between the maſtoide and ſtyloide proceſſes, and tranſmitting the hard portion of the auditory nerve; 3. a foramen behind the maſtoide proceſs ſerving for the ingreſs of a vein into the lateral ſinus, or for the egreſs of one from the lateral ſinus into the veins of the occiput. In the occipital bone there are two foramina ſituated behind the condyloide apophyſes, and ſerving to give paſſage to the vertebral veins into the lateral ſinuſes of the dura mater; theſe, however, are wanting in many ſkulls. In the ſphenoides, beſides the internal ones already deſcribed, are the apertures of the ſinuſes into the noſtrils, common to them with the bones of the palate, and which are the apertures of the nares and fauces; there is another canal in the upper part of the pterygoide proceſſes, ſerving for the paſſage of the novum emiſſarium of the dura mater. In the os æthmoides there are, firſt, thoſe common to this bone with the os frontis, ſituated in the interior ſide of the orbit (already deſcribed;) and ſecondly, the apertures of the æthmoidal ſinuſes into the noſtrils.

In the examination of different ſkulls, other foramina beſides theſe will occaſionally be found in different places; but ſuch are either extraordinary and luſus naturæ (as is often the caſe) or they are otherwiſe ſuch as ſerve only to give paſſage to veſſels ſerving for the nutrition of the bones in which they are placed.

For the foramina of the bones of the face, ſee the preceding ſection; and for thoſe of the internal ear, Chap. viii. Sect. 5.

SECT. IV.

Of the CARTILAGES, LIGAMENTS, &c. of the HEAD.

Cartilages of the head.

THE condyloide apophyſes of the os occipitis, the glenoide cavities or articular foſſulæ of the oſſa temporum, the eminences next theſe cavities and the condyloide apophyſes of the lower jaw, are all cruſted over with very white and ſmooth cartilages; and there is likewiſe in each articulation of the lower jaw a looſe cartilage upon which the condyloide proceſs moves on one ſide, while the jaw is moved to the other.

The remaining cartilaginous ſubſtances of the head, viz. thoſe of the noſe, ears, &c. ſerving only to ſhape the parts, and not belonging to the articulations, are here omitted, and the reader is referred to the muſcular deſcription of thoſe parts.

Ligaments of the head.

The ligaments of the bones of the head are, 1. thoſe between the occipital condyles and the ſuperior apophyſes of the firſt vertebra of the neck; 2. thoſe between the os occipitis and apophyſis dentiformis of the ſecond vertebra; 3. thoſe of the articulation of the lower jaw with the temporal bones;

4. thoſe by which the os hyoides is connected to the ſtyloide apophyſes. For the ligaments which connect the cartilages of the ears and thoſe of the noſe, orbits, and eye-lids, ſee the muſcular deſcription of thoſe parts.

Glands of the joints. The true mucilaginous glands of the occipital and maxillary articulations, have nothing peculiar to them; they are proportioned to the joints to which they belong, and lie between the capſular ligaments and circumference of the cartilages.

S E C T. V.

Of the MUSCLES of the HEAD.

Muſcles of the head. THOUGH the muſcles which move the head on the trunk are in general termed muſcles of the head (notwithſtanding they alſo belong to the neck) I ſhall firſt deſcribe thoſe of the cranium.

Occipito-frontalis. Occipito frontalis is a muſcle with four fleſhy bellies, commonly diſtinguiſhed by the names of frontales and occipitales. It ariſes behind each ear from the os occipitis, and ſoon becoming tendinous, paſſes under the hairy ſcalp to the forehead, where it becomes broad and fleſhy, adhering to the ſkin, and is inſerted into the upper part of the orbicularis palpebrarum into the os frontis near the noſe, and by two proceſſes into the bones of the noſe. When this muſcle acts from the back part, it pulls the ſkin of the forehead upward, wrinkling tranſverſely, and, in ſome perſons, the hairy ſcalp backwards;

but when the fore-part of it acts, it draws the ſkin with the eye-brows downward, and towards the noſe when we frown.

The orbicularis palpebrarum ſurrounds the eye-lids on the edge of the orbit, and is fixed to the ſutura tranſverſalis at the great corner of the eye. It ariſes from the upper apophyſis of the maxillary bone, near the great canthus of the orbit; it ſhuts the eye-lids, eſpecially in winking, and ſerves to depreſs and draw forward the eye-brow at the ſame time, and elevates the lower eye-lids. Orbicularis palpebrarum.

The corrugator ſupercilii is ſo conjoined with the orbicularis palpebrarum, that it may be reckoned a part of it, to which the reader is referred. Corrugator ſupercilii.

The ciliaris is alſo a very ſmall portion of the orbicularis, next the ciliary cartilages of the eye-lids. Ciliaris. The tarſi are thin cartilages, forming the principal part of the edge of each eye-lid; and they are broader at the middle than at the extremities; the extremities of both cartilages are connected by a kind of ſmall ligaments. Tarſi.

The broad ligaments of the tarſi are membranous elongations formed by the union of the perioſteum of the orbits and pericranium along both edges of each orbit. The ſuperior ligament is broader than the inferior, and fixed to the ſuperior edge of the upper cartilage, as the inferior is to the lower edge of the lower cartilage; ſo that theſe ligaments and the tarſi taken alone or without the other parts, repreſent the eye-lids. Ligamenta tarſorum lata.

The elevator palpebræ ſuperioris is a very thin muſcle, which ariſes from the perioſteum at the bottom of the orbit of the eye, where the optic nerve goes through the cranium, Elevator palpebræ.

nium, and paſſing above the attollens is inſerted into the whole ciliary cartilage of the upper eye-lid by a very thin broad tendon.

The globe of the eye is moved by four ſtrait and two oblique muſcles, viz.

Elevator oculi.

1. The rectus attollens vel elevator oculi, lies on the upper part of the globe, pulling up the ball of the eye when we look up, and is therefore by ſome termed ſuperbus. It ariſes from the bottom of the orbit, between the optic nerve and the elevator palpebræ ſuperioris, and is inſerted in the upper part of the tunica ſclerotis, near the cornea.

Depreſſor oculi.

2. Rectus deprimens vel depreſſor oculi, is ſometimes named humilis, becauſe it pulls down the eye; it ariſes and is inſerted directly oppoſite to the elevator oculi.

Adductor oculi.

3. Rectus adducens vel adductor oculi, draws the eye towards the noſe; it ariſes from the bottom of the orbit, near the optic nerve internally, and is inſerted into the tunica ſclerotis on the ſide next the noſe.

Abductor oculi.

4. Rectus abducens vel abductor oculi, draws the eye towards the little canthus, and hath both its origin and inſertion directly oppoſite to the adductor.

The four ſtrait muſcles terminate about the cornea by four ſhort, thin, flat tendons; when they act all together, they draw the eye towards the bottom of the orbit.

Obliquus inferior.

1. Obliquus inferior is the firſt of the oblique muſcles, and the fifth muſcle of the eye; it ariſes from the lower ſide of the orbit, near its external edge, where the bones of the os maxilla ſuperioris join together; and aſcending obliquely by the outer corner of the eye, and paſſing over the depreſſor, it is inſerted behind the tendon of the abductor,

tor, into the external ſide of the globe of the eye, which it draws forward and turns upward.

Obliquus ſuperior vel trochlearis.

2. Obliquus ſuperior vel trochlearis, is the ſecond oblique muſcle, and the ſixth muſcle of the eye; it ariſes from the bottom of the orbit, between the elevator and adductor oculi, and runs obliquely towards the great canthus; in the upper and inner parts of the orbit near its edge there is a cartilaginous ring or pulley, through which it paſſes in a round tendon and is inſerted near the bottom of the globe of the eye, which it pulls upward and inward, and thereby directs the pupil outward and downward.

For the coats, and humors, &c. of the eye, ſee Chap. viii. Sect. 4.

Muſcles of the external ear.

The muſcles of the external ear are in human ſubjects extremely ſmall, and often ſcarce diſcernible without the help of a microſcope; their uſe is very inconſiderable, though it is ſuppoſed they render the ear tenſe, when we would hear more diſtinctly; therefore they are here inſerted, for the ſatisfaction of the curious.

Cartilage and ligament.

The greateſt part of the external ear conſiſts of a large cartilage which is the baſis of all the other parts of which this portion of the ear is made up. It is fixed to the cranium, not only by the cartilaginous portion of the meatus auditorius, (deſcribed hereafter) but alſo by two ligaments, one anterior and the other poſterior. The anterior ligament is fixed by one extremity to the root of the apophyſis zygomatica of the os temporis, and by the other extremity to the anterior and ſuperior part of the cartilaginous meatus. The poſterior ligament is fixed by one end to the root of the maſtoide apophyſis, and by the other to the poſterior part of the convexity of the concha, ſo that it is oppoſite to the anterior ligament.

Elevator auriculæ.

Attollens vel elevator auriculæ is a muſcle that has a very thin tendinous origin from the tendon of the occipito frontalis, and is inſerted into the upper and fore-part of the protuberance in the back of the cartilage of the external ear.

Anterior auriculæ.

Anterior auriculæ is inſerted into the back of that eminence of the helix, which divides the concha, running through the ſame.

Retractor auriculæ.

Retractor vel retrahens auriculæ ariſes by one, two, or three ſmall portions from the temporal bone above the mammillary proceſs; the tendinous end of the upper and middle parts is inſerted into the lower part of the back of the upper cavity of the external ear; and the lower portion of this muſcle is inſerted into the back of the lower cavity into which the concha is divided by the eminence of the helix running through it. This muſcle pulls the ear backward.

Helix major.

Helix major ariſes from the upper part of the outer ſide of the acute proceſs of the helix, and is inſerted ſometimes outwardly into the helix, or elſe runs along the ſurface of the elevator auticulæ.

Helix minor.

Helix minor aſcends near the helix, on the fore-part of the outer ear, where the concha has an inciſure or notch; one end is fixed below the notch, the other above it.

Tragicus.

Tragicus ariſes from the middle of the outer ſide of the cartilage of the concha near the tragus, and terminates in the upper part of the tragus and adjacent part of the concha.

Antitragicus ariſes from the outer part of the cartilage of the antitragus where it is moſt protuberant, and is inſerted into the edge of the concha in the angle of the notch, behind the antitragus at the bottom of the helix.

Antitragicus.

Tranſverſus auriculæ is divided into two parts; the part belonging to the antihelix is inſerted into a hollow on the back of the antihelix, and a ſmall part of it into the protuberant back of the ſcapha. The part belonging to the ſcapha is again divided, for a conſiderable length, into ſeveral leſs diſtinct and almoſt tendinous muſcles; it ariſes from the upper part of the back of the ſuperior cavity of the concha, and is inſerted into the lower part of the protuberance in the back of the ſcapha.

Tranſverſus auriculæ.

I come now to deſcribe the muſcles of the internal ear.

Muſcles of the internal ear.

Laxator tympani ariſes from the upper part of the edge of the tympanum, near the end of the auditory paſſage, from the place to which the membrane of the tympanum adheres; it is inſerted into the handle of the malleus, near the root of its ſhorter proceſs.

Laxator tympani.

Externus mallei ariſes from the outer part of the acute proceſs, which the laſt angle of the multiform or ſphenoidal bone ſends out betwixt the os ſquamoſum and petroſum; the tendon which enters the ſlit, that is left at the end of the ſuture of the os ſquamoſum and petroſum, afterwards goes on through the ſame ſinus as holds the longeſt and ſlendereſt leg of the malleus, to that part of the bony extremity which contains the auditory paſſage, and affixes itſelf to the whole length of

Externus mallei.

of that proceſs. Juſt above appears the tendon of the tenſor tympani coming out of the ſmall opening of the bony channel in which it is contained. Juſt below is the tendon of the ſtapedius (paſſing out of the little opening in the neck of the cavity in which the ſtapedius itſelf is contained) running to the ſtapes.

Internus mallei.

Internus mallei lies along the inſide of the Euſtachian tube, partly on the cartilaginous, and partly on the bony portion, being fixed by one extremity in the apophyſis petroſa.

Tenſor tympani.

Tenſor tympani ariſes from the upper part of the Euſtachian tube where it looks towards the baſis of the ſkull and is of a cartilaginous nature, near the hole of the ſphenoidal bone that admits arteries to the dura mater under its ſcale which is connected to the os petroſum at the inner ſide of the ſaid hole; its tendon is inſerted into the handle of the malleus.

Stapedius.

Stapedius is ſituated within the ſmall bony pyramid at the bottom of the tympanum; it terminates in a ſmall tendon, which goes out through a ſmall hole in the apex of the pyramid, and is inſerted into the back part of the head of the ſtapes.

Muſcles of the noſe.

Six muſcles are generally ſaid to belong properly to the noſe, viz. two compreſſors, two elevators, and two depreſſors.

Compreſſor narium.

Compreſſor narium on each ſide ariſes from the outer part of the root of the wings of the noſe, and is partly extenuated in form of a membrane, which joining with a like membranous extremity of the frontales, is interwoven therewith, and riſes with their fibres over the back of the anterior part of the noſe, till thoſe fibres of the right and left ſide there intermix, and are inſerted in the moveable cartilage which forms the ala of the nares.

Elevator alæ naſi et elevator labii ſuperioris has its origin from the naſal proceſs of the upper jaw-bone on each ſide near the greater canthus of the eye; the extremities which run through the upper lip near the ſide of the noſe are gradually extenuated over the fore-part of the naſalis of the upper lip, and are inverted in the moveable cartilage near the os maxillare, inſerting fibres as they paſs into the upper part of the wings of the noſe near the cheek. Elevator alæ naſi.

Depreſſor alæ naſi ariſes on each ſide from the upper jaw bone outwardly, where the gums cover the ſockets of the dentes inciſores and canini; it is inſerted round the root of each wing of the noſe, and under, or within each noſtril from the ſeptum naſi where that joins with the lip to the wing of the noſe. Depreſſor alæ naſi.

The inferior portion of the external noſe is compoſed of ſeveral cartilages, which are commonly five in number, and of a pretty regular figure. The reſt are only additional, ſmaller, more irregular, and the number of them more uncertain. Of the five ordinary cartilages one is ſituated in the middle, the other four laterally; the middle cartilage is the moſt conſiderable, and ſupports the reſt, being connected immediately to the bony parts; but the other four are connected to the middle cartilage, and to each other, by means of ligaments. Cartilages of the noſe.

Orbicularis, but more properly ſphincter vel conſtrictor oris, ſurrounds the whole mouth about three-fourths of an inch broad; Sphincter oris.

this muſcle is very much intermixed with all the muſcles that are inſerted into it.

Elevator labii ſuperioris.

Elevator labii ſuperioris proprius ariſes from the bones of the upper jaw, under the anterior and inferior part of the orbicularis palpebrarum, and uſually takes another ſmall beginning from the os malæ, which ſeems as if it was ſent off from the orbicularis palpebrarum; and paſſing down by the ſide of the noſe, into which it ſends ſome fibres, is inſerted into the upper part of the ſpincter oris. This raiſes the upper lip and helps to dilate the noſtrils.

Depreſſor labii ſuperioris vel naſalis.

Depreſſor labii ſuperioris proprius, vel naſalis, is a ſmall muſcle ariſing from the upper jaw near the dentes inciſores, and is inſerted into the upper part of the lip, and root of the cartilages of the noſe; hence it is alſo a depreſſor of the noſe, which action conſtricts the noſtrils.

Elevator labii inferioris.

Elevator labii inferioris proprius ariſes from the lower jaw near the dentes inciſores, and is inſerted into the lower part of the under lip.

Depreſſor labii inferioris.

Depreſſor labii inferioris proprius ariſes broad from the lower jaw at the chin, and is ſoon inſerted into the ſphincter oris.

Elevator anguli oris.

Elevator anguli oris, vel labiorum communis, ariſes from a depreſſed part of the ſuperior maxilla under the middle of the orbit, and is inſerted into the ſpincter muſcle near the corner of the mouth.

Depreſſor anguli oris.

Depreſſor anguli oris, vel communis labiorum, ariſes laterally from the lower jaw near the chin, and is inſerted into the ſphincter oppoſite to the elevator anguli oris.

Elevator menti ariſes from the fore-part of the lower jaw, immediately beneath its upper edge, from the ſocket of the lateral inciſive tooth; and extending from thence on one ſide to the ſocket of the middle inciſive, and on the other ſide, to the ſocket of the canine tooth. Where its fibres are incurvated towards each other, it partly continues, and partly intermixes with the fat of the chin. **Elevator menti.**

Zygomaticus is a muſcle ariſing from the os zygoma or malæ, near its conjunction with the long proceſs of the os ſquamoſum, and is inſerted into the ſpincter at the corner of the mouth, between the elevator anguli oris and buccinator; it draws the corner of the mouth outward and upward. **Zygomaticus.**

Buccinator ariſeth broad and fleſhy from the fore part of the proceſſus coronæ of the lower jaw bone, and adhering to the gums of both jaws is inſerted into the ſpincter at the angle of the lips; it brings the food between the teeth in maſtication, forces the breath out of the mouth in blowing, &c. and pulls the lips or corner of the mouth outward. Steno's ſalival duct perforates this muſcle in the middle. **Buccinator.**

Platyſma myoides vel latiſſimus colli is a broad membranous muſcle, exceeding thin, and lies immediately under the ſkin; it ariſeth from the pectoral muſcle below the clavicle, and from part of the deltoide muſcle; it runs obliquely forward, covering all the neck, rendering the unequal ſurface of the ſubjacent muſcles even, and is inſerted into the chin and depreſſor muſcles of the lip. When it acts, it pulls down the corner of the mouth and the lower jaw. A con- **Platyſma myoides.**

convulſion herein, is called the cynic ſpaſm.

Biventer. Biventer, or digaſtricus, ariſes with a fleſhy belly from the upper part of the maſtoide proceſs, and deſcending, it contracts into a round tendon which paſſes through the ſtylohyoideus and an annular ligament which is faſtened to the os hyoides, then growing fleſhy again, it aſcends towards the middle of the edge of the anterior part of the lower jaw, where it is inſerted internally. When it acts, it pulls the lower jaw down by means of this trochlea or pully, and ſerves to draw up the os hyoides and parts annexed to it in deglutition, as well as to prevent theaction of ſeveral muſcles which are concerned in ſwallowing; for which reaſon, we cannot ſwallow at the ſame time that we open our mouth.

Temporalis. Temporalis ariſes from part of the os frontis, parietale, ſphenoides, malæ, and temporale; from whence going under the two proceſſes of the zygoma it is inſerted by a ſhort ſtrong tendon externally into the proceſſus coronalis of the lower jaw, which it pulls upward: this muſcle is covered with a ſtrong tendinous faſcia.

Maſſeter. Maſſeter is a thick fleſhy muſcle, ſituated at the back part of the cheek; it has its origin in the lower edge of the interior part of the os malæ, and the zygomatic proceſs which joins this from the temporal bones. It is inſerted into the external ſuperfices of the angle of the lower jaw, which it pulls upward and forward; over this muſcle paſſes Steno's ſalival duct.

Pterygoideus internus. Pterygoideus internus ariſes from the cavity of the pterygoide proceſſes and is inſerted internally into the angle of the lower jaw, which it pulls upward.

Pterygoideus externus ariſes from the os maxillare and os ſphenoides, near the root of the external pterygoide proceſs, and is inſerted internally into the condyloide proceſs of the lower jaw, which it pulls to one ſide, and forwards, or acting with its partner pulls the jaw directly forward. Pterygoideus externus.

The four following muſcles belong to the palate; ſome authors mention many others, which minute diviſions and deſcriptions being of no uſe, they are here purpoſely omitted. Muſcles of the palate.

Pterygoſtaphylinus internus ariſes from the os ſphenoides, near the tuba Euſtachiana, and is inſerted into the uvula, which it pulls up while we breathe through the mouth, or ſwallow. Pterygoſtaphylinus internus.

Pterygoſtaphylinus externus ariſes by the ſide of the laſt deſcribed muſcle, and is alſo inſerted near it, but becomes its antagoniſt by being reflected on a pulley, over a proceſs at the lower part of the pterygoidal proceſſes of the ſphenoidal bone. Pterygoſtaphylinus externus.

Thyroſtaphylinus ariſes from the lateral part of the thyroide cartilage, and aſcending towards the uvula, becomes larger and is inſerted in manner of an arch, in the ſide of the velum palatinum. Thyroſtaphylinus.

Gloſſo-ſtaphylinus is a very ſmall portion of muſcular fibres which paſs from the tongue to the palate, which it pulls down when we breathe through the noſe. Gloſſoſtaphylinus.

The palate itſelf is a ſort of double muſcle, whoſe action ſeems only to ſupport itſelf, and aſſiſt thoſe muſcles which pull it upwards.

The os hyoides is moved by five pair of muſcles.

Genio-hyoideus. The firſt is the genio-hyoideus; it ariſes from the fore part of the lower jaw internally, and is inſerted into the baſis of the os hyoides, which it pulls upward and forward.

Sterno-hyoideus. The laſt deſcribed muſcle's antagoniſt is the ſterno-hyoideus, which ariſes from the inſide of the under part of the clavicle near the ſternum, and the cartilaginous part of the firſt rib, and aſcending above the ſterno-hyoideus, is inſerted into the baſis of the os hyoides which it pulls downward.

Mylo-hyoideus. The third is the mylo-hyoideus, which ariſes from the inſide of the bottom of the lower jaw, under the dentes molares, and is inſerted into the baſis of the os hyoides. Beſides the common uſe aſcribed to this muſcle, (which is to move the hyoides, tongue and larynx, both upwards, inwards, and ſide-ways,) it has a farther uſe when it is at reſt, and that is to compreſs the glands under the tongue, and by this means promote the diſcharge of the ſaliva into the mouth from the lower ſalival ducts; whence it is we uſe this muſcle when we want ſaliva in the mouth.

Coraco-hyoideus. The mylo-hyoideus's antagoniſt is the coraco-hyoideus, which ariſes from the upper edge of the ſcapula near the proceſſus coracoides, and paſſing obliquely under the maſtoideus, is inſerted into the baſis of the os hyoides, and draws it obliquely downwards.

Stylo-hyoideus. The fifth pair is the ſtylo-hyoideus, ariſing from the ſtyloide proceſs, and is inſerted in the horn and baſe of the os hyoides, which it pulls upward and backward. This muſcle is often perforated about the middle, by the tendon of the digaſtric muſcle of the lower jaw.

Muſcles of the tongue.

The muſcles of the tongue, (beſides thoſe of the os hyoides already mentioned,) are as follows.

Genio-gloſſus.

Genio-gloſſus ariſes from the fore-part, or proceſſus inominatus of the lower jaw internally, and is inſerted broad into the under part of the root of the tongue, and ſometimes there is a ſmall inſertion into the os hyoides. When this muſcle and its fellow act, they pull the tongue forwards, and thruſt it out of the mouth.

Baſio-gloſſus.

Baſio-gloſſus ariſes from the baſis of the os hyoides, and is inſerted into the tongue near its apex or tip; its uſe (with the aſſiſtance of the cerato-gloſſus) is to draw the tongue backward and make it ſhorter.

Cerato-gloſſus.

Cerato-gloſſus ariſes from the horn of the os hyoides, whence it has its name; it is inſerted laterally into the tongue near its root, and draws the tongue obliquely to one ſide; but if both act at once, the tongue is pulled directly backwards into the mouth.

Stylo-gloſſus.

Stylo-gloſſus ariſes from the apex of the ſtyloide proceſs, and is inſerted into the root of the tongue which it moves upward and backward.

Chondro-gloſſus.

Chondro-gloſſus ariſes from the cartilaginous proceſs of the os hyoides, meeting in the baſis of the tongue, where they are inſerted. This pair is not found in all ſubjects.

Lingualis.

Lingualis ariſes, pretty large and fleſhy, from the baſis of the tongue laterally, and runs ſtrait forwards between the cerato-gloſſus and genio-gloſſus, to its apex or tip;

where it is hard to determine whether it ends there, or if it returns circularly after the ſame manner on the other ſide to the root of the tongue again. Its uſe is to contract or narrow the ſubſtance of the tongue, and at the ſame time to bring it backwards and downwards.

The tongue itſelf.

The tongue itſelf is a muſcle made of fibres, longitudinal, circular, and tranſverſe, ſo intermixed as beſt to ſerve its ſeveral motions. This is the interior part of the tongue; thoſe before mentioned are the extrinſic muſcles, or muſculi linguæ exteriores, which by one extremity make a part of the body of the tongue, being inſerted into it.

Muſcles of the head.

The muſcles which move the head on the trunk, and are properly called muſcles of the head, are as follows.

Rectus internus major.

Rectus capitis internus major anticus ariſes from the anterior part of the tranſverſe apophyſes of the five lower vertebræ of the neck, and paſſing over the two ſuperior vertebræ, is inſerted into the os occipitis, near the fore-part of the great foramen. This muſcle bends the head forward on the firſt and ſecond vertebræ of the neck.

Rectus internus minor.

Rectus capitis internus minor anticus ariſes from the anterior ſurface of the Atlas or firſt vertebra of the neck; it lies concealed as it were, under the former, and is inſerted a little behind it, into the os occipitis. This muſcle alſo moves the head forward on the firſt vertebra.

Rectus major poſticus.

Rectus capitis major poſticus is one of the extenſors of the head, which has its origin from the ſpinal apophyſis of the epiſtrophæus or ſecond vertebra of the neck, and is inſerted into the lower part of the os occipitis;

tis ; and though it is called rectus, it is ſituated obliquely between the occiput and ſecond vertebra of the neck. It pulls the head back on the firſt and ſecond vertebra.

Rectus mi-nor poſticus.

Rectus capitis minor poſticus is alſo an extenſor of the head, having its riſe from the poſterior part of the Atlas, and is inſerted below the former, into the os occipitis, to pull the head back on the Atlas or firſt vertebra.

Rectus lateralis.

Rectus lateralis has its origin from the anterior part of the upper ſurface of the tranſverſe proceſs of the Atlas ; from this it aſcends ſtrait, with a ſhort body, but conſiderably thick, and is inſerted partly into the os occipitis, and partly into the os temporis near the inciſure of the maſtoide proceſs. This turns the head on one ſide.

Obliquus inferior.

Obliquus capitis inferior ſive major ariſes from the ſpinal apophyſis or proceſs of the ſecond vertebra of the neck, and is inſerted into the tranſverſe apophyſis of the firſt vertebra. When this acts, it turns the head with the Atlas in a rotatory manner on the ſecond vertebra, whoſe proceſſus dentatus is the axis of the motion.

Obliquus

Obliquus capitis ſuperior ſive minor has its origin from the end of the tranſverſe apophyſis of the Atlas, and is inſerted into the os occipitis, and back part of the os temporis near the rectus major. When but one of theſe acts, it aſſiſts the rectus lateralis on the ſame ſide, but when they act both together they pull the head back.

The muſcles which ſerve both the head and neck conjointly, are deſcribed in the next chapter, which ſee.

SECT. VI.

Of the BRAIN.

Viſcera of the head.

THE parts contained in the cranium are the brain; which is a ſoft white maſs, in which all the organs of ſenſe terminate, and the ſoul is ſuppoſed principally to reſide.

The brain is ſurrounded by two membranes called meninges and matres; theſe are the dura mater, and the pia mater; ſome make the external lamina of the latter to be a diſtinct membrane called arachnoides. The general maſs is divided into three particular portions; the cerebrum or brain, properly ſo called; the cerebellum; and the medulla oblongata.

Diviſion of.

To theſe three parts, contained within the cranium, ſome add a fourth, viz. the medulla ſpinalis, which is a continuation of the medulla oblongata, and fills the great canal of the ſpina dorſi.

Cerebrum, its ſituation.

The cerebrum, or brain, properly ſo called, is a kind of medullary maſs of a moderate conſiſtence, and of a greyiſh colour on the outer ſurface, poſſeſſing all the cavity of the upper and fore-part of the cranium, or that portion which lies above the tranſverſe ſeptum.

Figure.

The upper part of the cerebrum is of an oval figure, like half an egg cut lengthways, or rather like two quarters of an egg, and parted a little from each other.

Diviſion and lobes.

It is flatter on the lower part; each lateral half of which is divided into three eminences called lobes, one anterior, one middle, and one poſterior. Its upper ſide is divided into two hemiſpheres by means of the proceſſus falciformis of the dura mater, and its lower ſide into four lobes, two anterior, and two poſterior, which latter are much the largeſt. At the meeting of the four lobes appears the infundibulum, which is a kind of lymphatic running from the ventricles of the brain, piercing the dura mater upon the baſis of the ſkull, and ſinks into the ſubſtance of the glandula pituitaria. This gland is ſeated in the ſella turcica.

Infundibulum.

Each lateral portion of the cerebrum has three ſides; one ſuperior, which is convex; one inferior, which is uneven; and one lateral, which is flat, and turned towards the falx. Through the whole ſurface of theſe three ſides, we ſee inequalities or windings, like the circumvolutions of the inteſtines, formed by waving ſtreaks or furrows, very deep and narrow, into which the ſepta of the pia mater inſinuate themſelves.

Sides and inequalities.

The human brain is three times as much in quantity as the brain of an ox; it being in general about four pounds weight.

Quantity.

The ſubſtance of the cerebrum is of two kinds; the exterior, or cortical part, and the interior or medullary part. The cortical, cineritious or glandulous ſubſtance of the brain, is about a ſixth of an inch in thickneſs, and is of a ſoftiſh greyiſh or aſh-colour: the interior medullary ſubſtance is fibrous and tubular, more ſolid than the former, and very white. This laſt has its origin from the extremely ſmall arteries of the cortical part; and its termination is in the beginning of the nerves.

Subſtance and colour.

Corpus callosum.

Corpus calloſum is a white hard ſubſtance between the two hemiſpheres of the cerebrum, which covers the two lateral ventricles.

Ventricles.

The ventricles of the brain are cavities lined with a fine ſmooth membrane (which is, no doubt, a continuation of the pia mater) and all communicate with one another. They are always contiguous to one another, as the pleura and lungs, except where the plexus choroides fills up the ſpace betwixt them; but there is a moiſt vapour within, that hinders them from growing together, to which moiſture, a cluſter or cluſters, more or leſs, of the plexus choroides in every ventricle greatly add, as well as to the heat of the ventricles.

Lateral ventricles.

Of theſe cavities or ventricles, the two called anterior, lateral, or ſuperior, are very extenſive, and wind in ſuch a manner that there is hardly any medullary part of the brain at a remarkable diſtance from the walls of one or other of them, as they are fellows, one on one ſide, and another on the other. Where they approach neareſt to one another they are ſeparated only by the ſeptum lucidum (as below). The other two ventricles, called the third and fourth, are ſingle in their kinds, and very ſmall in compariſon with the two former.

The third ventricle.

The third ventricle is formed by a kind of mechanical neceſſity, being a furrow ariſing from two round medullary veſicles (called thalami nervorum opticorum, applied to one another.

The fourth ventricle.

The fourth ventricle is ſuch another furrow, between the medullary productions of the brain and cerebellum, as they are going to be united.

The ſeptum lucidum is an extreme thin membrane or partition, which divides the two ſuperior or lateral ventricles of the brain, and is extended between the corpus calloſum and fornix; it is compoſed of a fine medullary ſubſtance, formed into two ſides, with a longitudinal cavity between them. Septum lucidum.

Fornix is placed under the ſeptum lucidum, and like it, compoſed of a medullary ſubſtance. Its anterior part riſes from the fore-part of the ventricles with a double baſe, but the two parts ſoon unite; the hinder part is likewiſe bifid, and thence called crura fornicis, and by ſome pedes hypocampi. Fornix.

In the baſis of the lateral ventricles of the brain are four great prominences; the two anterior are called corpora ſtriata, and the other two are termed thalami nervorum opticorum. Great prominences.

Corpora ſtriata are two prominences, ſo called from their inner texture appearing of a greyiſh colour, by the great number of white and aſh-coloured lines alternately diſpoſed, which we meet with in ſcraping them with a knife. Corpora ſtriata.

Thalami nervorum opticorum are two prominences, ſo named becauſe theſe nerves ariſe chiefly from them; they are of a medullary ſubſtance without, but a little cineritious within, like the corpora ſtriata. Thalami nervorum opticorum.

There are alſo four ſmall prominences, which are cloſely united together; the two anterior being called nates, and the two poſterior teſtes. Small prominences.

Nates cerebri are two circular protuberances or proceſſes of the brain, ſituated on Nates cerebri.

the poſterior part of the medulla oblongata near the cerebellum.

Teſtes Cerebri.

Teſtes cerebri are two little, round, hard bodies, between the four ventricles of the brain near the pineal gland, under the nates, but nearer the cerebellum.

Plexus Choroides.

Plexus choroides is a number of blood-veſſels, glands, and lymphæducts, ſituated upon the thalami nervorum opticorum.

Foramina Cerebri.

Under the beginning of the fornix is a ſmall hole, called foramen ad radices fornicis, or iter ad infundibulum; and under the middle of the fornix, one called foramen poſterius, which is covered with a valve named membrana, or valvula magna cerebri; and the ſpace under the two anterior ventricles between the foramina and the cerebellum is the third ventricle before mentioned.

Cerebellum, its ſituation and figure.

Cerebellum is ſituated under the poſterior lobes of the cerebrum or brain, and the hinder proceſſes of the dura mater; in the lower part of the cavity of the cranium; its figure approaches to a globular one; its ſuperficies is leſs anfractuous or gyrated than that of the cerebrum or brain; but it is furrowed and depreſſed, and largeſt in the middle, gradually diminiſhing, till at laſt they terminate, in the vermiform proceſs.

Subſtance.

The ſubſtance of the cerebellum is much the ſame with that of the cerebrum or brain; but the cortical part is here much more in quantity than the medullary; the latter is inmoſt as in the cerebrum, yet it is of a different ſhape, being elegantly branched out like ſhrubs or little trees; the trunks (which are the baſis of the cerebellum) for what are called the peduncles of the cerebellum.

Though the cerebrum has its ſeveral cavities, the cerebellum has none.

Lobules. The lobules of the cerebellum adhere in cluſters to the arbuſculi medullares; they are ſurrounded by the pia mater, and compoſe the far greater part of the cerebellum.

Peduncles. The peduncles of the cerebellum conſiſt of the medullary proceſſes; the firſt aſcends from the cerebellum towards the teſtes, and forms the valvula magna of the brain; the ſecond forms the annular prominence of Willis, and the third deſcends to the ſpinal marrow.

Medulla oblongata. Medulla oblongata is a medullary continuation of the under part of the cerebrum and cerebellum, formed into a kind of tail, and extended to the great foramen in the os occipitis, where it gives origin to the medulla ſpinalis, and to the nerves of the brain. It firſt appears in two bodies from the anterior part of the poſterior lobes of the cerebrum, called crura medullæ oblongatæ; the union of theſe crura, between the cerebrum and the cerebellum, is called iſthmus; and immediately beyond this is an eminence named proceſſus annularis. The medulla oblongata is juſtly eſteemed a third general part of the encephalon or whole maſs of the brain; or as the common production, or united elongation (above mentioned) of the whole medullary ſubſtance of the cerebrum and cerebellum.

Medulla ſpinalis. Medulla ſpinalis is a continuation of the medulla oblongata, through the great foramen of the ſkull, and through the bony canal of the ſpina dorſi, to the extremity of the os ſacrum.

Thickneſs. Its thickneſs in general is nearly equal to that of a finger; but it is not uniformly of the ſame diameter throughout.

Subſtance. Its ſubſtance in the upper part at the laſt ſuperior vertebra of the thorax, (where the large nerves are given off to the arms) is the ſame with that of the medulla oblongata of the brain, but larger, and ſomewhat tougher, and more firm: they are externally of a medullary ſubſtance that the nerves may eaſily make their way out; internally, cineritious, and of the ſame nature with the cortical part of the brain: but the lower part, from the loins (where the crural nerves begin) to the extremity of the os ſacrum, is again larger fibrous, and very tenacious, and is called (from its reſemblance) cauda equina.

Integuments. Next the bony canal of the ſpine internally, is a very ſtrong tunica, which connects the vertebræ within; and then, the cellular or adipoſe coat, which in fat perſons, always contains more or leſs fat, and ſeems deſtined by nature to ſoften the former. Another of its integuments is the dura mater, (deſcribed below,) which is ſtronger in the upper part, and finer and weaker in the lower; this membrane looſely incloſes the medulla in the ſpine, and in its anterior part is firmly connected with the vertebræ: alſo, the tunica arachnoides, which in its anterior part adheres very firmly to the pia mater, (being in fact its external membrane) but in its poſterior part is looſe and fluctuating. The pia mater ſurrounds every part of the medulla ſpinalis, and all the nerves that ariſe from it, and enters alſo its longitudinal diviſion.

Veſſels. The arteries and veins of the medulla ſpinalis enter at the apertures of the vertebræ, which give paſſage out to the nerves; they make a multitude of anaſtomoſes, and are derived from the vertebrals of the neck, the intercoſtals and the lumbar. See Chap. i. Sect. 5 and 6. Of Arteries and Veins in general.

Nerves. The nerves of the ſpine are thirty one, or as others count them, thirty-two pair; theſe are compoſed each of a multitude of fibres, ariſing from the anterior and poſterior parts of the medulla; theſe fibres afterwards unite, and are connected by, and covered with membranes, and in that ſtate they conſtitute what we call nerves.

Uſe. The uſe of the ſpinal marrow is to give origin to the beforementioned nerves, which are principally diſtributed to the limbs and external parts; and to ſecrete and prepare a nervous fluid.

Membranes of the brain. The encephalon or whole maſs of the brain, viz. the cerebrum, cerebellum, and medulla oblongata, are incloſed (as before obſerved) by two membranes, named dura mater and pia mater; the latter is the innermoſt, immediately involving the brain; and the former is the external membrane, which covers the whole.

Pia mater. Pia mater is a thin and exceeding fine double membrane, which immediately, cloſely, and firmly, involves the brain; its inner membrane is much larger than the outer, being extended between the lobes, hemiſpheres, and all the foldings and circumvolutions of the brain; it inſinuates itſelf into all its cavities, and is carried down to the bottom of all its furrows.

Uſe. It ſerves to contain the brain, and ſupport its blood-veſſels, which run here in great number, and make ſeveral turnings and windings upon it, to divide the arteries into ſmall branches, before they terminate in the ſubſtance of the brain, that the blood may not enter it too impetuouſly; and for the veins to unite on, that they may enter the ſinuſes in fewer and larger branches. In ſhort, it ſeems in a manner wholly compoſed of blood-veſſels; whoſe diſtribution thro' all its furrows and anfractuoſities, ſerves alſo to ſecrete proper fluids in the brain, and to form the animal ſpirits. Veſſels. The arteries are from the internal carotids, and vertebrals: ſome of the veins diſcharge themſelves into the ſinuſes of the dura mater, and others immediately into the jugular and vertebral veins.

The outer membrane of the pia mater is by ſome made a diſtinct coat, and called arachnoides.

The pia mater covers alſo the the medulla ſpinalis, (as before obſerved) and its membranes adhere very cloſely and firmly to one another, in the upper part of the head; but much leſs ſo with the dura mater.

Dura Mater. Dura mater is a very compact, ſtrong, thick, membrane, compoſed of tendinous fibres; its figure and magnitude correſpond exactly to thoſe of the brain. Uſe. It lines the inſide of cranium, and ſupplies the place of an internal perioſteum, firmly adhering to its baſis, and but lightly at the upper part, except at the ſutures; it is ſpread in all the holes and depreſſions, and covers all the eminences in ſuch a manner, as to prevent their being hurtful to the brain. Proceſſes. It has three proceſſes; the firſt, named falx, begins at the criſta galli, and runs backwards under the ſutura ſagittalis, to the cerebellum, dividing the cerebrum into two hemiſpheres. Its uſe ſeems to be to divide the brain into ſuch portions as are leaſt liable to be moved in the ſkull, by any violent motions of the head; and the under ſide of the brain is kept ſteddy by the inequalities of the baſis of the ſkull, which the brain is exactly fitted to. The ſecond proceſs runs from the lower and back part of the former to the upper edge of each os petroſum, and ſuſtains the poſterior lobes of the cerebrum, that they might not compreſs the cerebellum. The third proceſs is very ſmall; it runs from the laſt deſcribed proceſs down towards the great foramen of the ſkull, and poſſeſſes the ſmall ſpace in the cerebellum, between the proceſſus vermiformis.

Theſe proceſſes of the dura mater ſerve alſo to keep the brain ſteady.

The dura mater receives arteries from the carotids, beautifully ramified in the manner of ſhrubs. Its veins are of two kinds; ſome, as in other parts of the body, and others of a triangular figure, called ſinuſes, which receive the blood from the leſſer veins of the brain, but their number is uncertain. The firſt is the longitudinalis ſuperior, running from a hole a little above the criſta galli all along the upper edge of the falx. On the lower edge of this proceſs is generally another very ſmall one, called longitudinalis inferior; this runs into the rectus, and when wanting is ſupplied by a vein.

Arteries.

Veins.

Sinuſes.

Rectus runs between the two firſt proceſſes of the dura mater, and unloads with the ſinus longitudinalis ſuperior (abovementioned) into the two lateral ſinuſes; but in general, the longitudinal ſinus goes more directly into one of the lateral ſinuſes, and the ſtrait ſinus into the other. There is ſometimes a ſmall one in the third proceſs, which empties in the ſame place with the former. From the ending of the longitudinal and ſtrait ſinuſes, begin the two lateral ſinuſes, which when they come to the os petroſum deſcend and paſs through the eighth foramina into the internal jugular veins. There is another named circularis, which runs round the fore part only of the ſella turcica; the two ends of this empty into four ſinuſes, one on the top of each os petroſum, which paſſes into the ſinus laterales, and one at the under ſides of the ſame bones, which paſſes indifferently into both lateral and cervical ſinuſes; theſe two laſt ſinuſes have always communicant branches. The cervical ſinuſes run from the baſis of the ſkull, thro' the great foramen on both ſides of the medulla ſpinalis colli, and through the tranſverſe proceſſes of the cervical vertebræ; the laſt of theſe have many times proper foramina, running from the eighth foramina to the back part of the apophyſes of the occipital bone.

There are alſo two more of theſe veſſels, which run from the circular ſinus between the os ſphenoides and fore-part of the os petroſum directly into the internal jugular veins. Theſe ſinuſes give warmth to the brain. The dura mater has nerves for ſenſation from the fifth and eighth pair of the brain. See Chap. i. Sect. 7.

Nerves.

This membrane has a motion, ſaid to be peculiar to itſelf, and of a muſcular kind, but it ſeems much more natural to ſuppoſe it is owing to the pulſations of the arteries of the brain.

In the ſinuſes of the dura mater, and out of them at the ſides, there are found a number of ſmall glands, deſcribed by Pachonius; and there are ſometimes others viſible in the foveæ of the os frontis, and about the diviſions of the veſſels between the dura mater and the pia mater. Glands.

Theſe glands ſeem deſtined for the ſecreting of a fluid to moiſten the dura mater.

The arteries that ſupply the cerebrum, cerebellum, and medulla oblongata come partly from the carotids, which enter the cranium through the canals in the apophyſis petroſæ of the temporal bones, and partly from the vertebrals which enter by the occipital foramen, and ſend off the arteriæ ſpinalis into the canal of the ſpine for the medulla ſpinalis. For a further deſcription ſee the next ſection. Arteries of the brain.

The veins of the brain are branches of the ſinuſes of the dura mater (already deſcribed). Veins of the brain.

Their principal ramifications accompany all the cortical circumvolutions of the cerebrum, and directions of the ſtrata of the cerebellum, running always in the duplicature of the pia mater. The veins of the plexus choroides in general, are of the number of theſe abovementioned. See a farther deſcription in the next ſection.

In the lower part of the medulla oblongata, are diſtinguiſhed the nerves of the brain, which are commonly ſaid to be ten pair, though in reality only nine: they are for the ſake of memory reduced into the form of two Latin verſes. Nerves of the brain.

Olfaciens, cernens, oculoſque movens, patienſque,
Guſtans, abducens, audienſque, vaganſque, loquenſque.

See more of the nerves in the next ſection.

Glandula Pinealis. Glandula pinealis is a ſmall gland, in the third ventricle of the brain, thus called from its reſemblance to a pine apple. It is a ſoft body, of a greyiſh colour, and no bigger than an ordinary pea, ſituated behind the thalami nervorum opticorum, above the tubercula quadrigemina, in the upper part of that foramen in the third ventricle of the brain, called the anus, and tied by ſome fibres to the nates. Its proceſſus and baſe are often medullary. This gland adheres very cloſe to the plexus choroides, by which it is covered. Deſcartes fixed the ſeat of the rational ſoul in this gland.

Glandula Pituitaria. Glandula pituitaria, is a ſmall gland of the brain, of the ſize of a very large pea; its colour is partly greyiſh, partly rediſh, and white within. Its ſubſtance is ſomewhat ſingular, being neither medullary nor glandular. Its figure is tranſverſely oval or oblong, and the lower part is ſometimes like a kidney bean. It is ſeated in the ſella of the os ſphenoides, between the ſphenoidal folds of the dura mater, and is covered by the pia mater as by a bag, the opening of which is the extremity of the infundibulum; from which it receives a lymph or juice, which the infundidulum derives from the plexus choroides and pineal gland; from this lympha the gland itſelf takes its name; it alſo filtrates a juice itſelf, ſeparating from the blood a white liquor, very ſubtile, and apparently very ſpirituous.

SECT.

SECT. VII.

Of the ARTERIES, VEINS, NERVES, and GLANDS of the HEAD.

Arteries of the head.

THE arteries of the head, both external and internal, proceed from the carotids, cervicals, and vertebrals; and their branches are called by the names of the parts they are beſtowed upon, as linguales, temporales, occipitales, &c. For the origin of theſe arteries, ſee the next chapter, ſect. v.

Arteria carotis externa.

The external carotid is anterior, and ſmaller than the internal carotid; its trunk runs up between the external angle of the lower jaw and the parotid gland, which it ſupplies as it paſſes; afterwards it aſcends on the foreſide of the ear and ends in the temple.

Internal branches.

In this courſe it ſends off internal branches in the following order; 1. ſublingualis vel ranina, to the muſcles of the os hyoides, the tongue, and glandulæ ſublinguales. 2. Maxillaris inferior, to the maxillary, parotid, and ſublingual glands, ſtyloide and maſtoide muſcles, muſcles of the pharynx, and to the ſmall flexors of the head. 3. Maxillaris externa, to the maſſeter, middle of the lower jaw, angles of the mouth, buccinator and elevator menti. A particular branch goes to the orbicularis vel ſphincter oris, and forms a kind of coronaria labiorum. It then goes to all parts of the noſe, and laſtly to the great angle of the eye, where it is ramified and loſt on the muſculus orbicularis palpebrarum, ſuperciliaris and frontalis; and is named arteria angularis. 4. Maxillaris interna, to the muſcles of the palate, glandular membrane of the poſterior nares, and to all the parts contained within the orbits of the eyes. A ſmall branch then enters the cranium through the ſphenoidal fiſſure, and is ſpent upon the dura mater; another ſmall branch goes to the maxillary ſinus and teeth; a principal branch runs through the canal of the lower jaw to the alveoli and teeth, and goes out at the hole near the chin to the neighbouring muſcles; a third principal branch goes up between the external and internal carotid to the dura mater. 5. A principal branch goes to the maſſeter muſcle.

External branches. The external branches of the external carotid are, 1. occipitalis, to the muſcles and integuments of the os occipitis, and a branch to the foramen maſtoidæum. 2. A principal branch ſupplies both the external and internal ear. 3. The trunk of the external carotid runs up (as abovementioned) between the external angle of the lower jaw and parotid gland, which having ſupplied, it forms the temporal artery, which divides into an anterior, middle, and poſterior branch. The anterior, to the muſculus frontalis, and ſometimes to the internal apophyſis of the os malæ all the way to the orbits. The middle, to the muſculus frontalis and occipitalis. The poſterior, to the occiput. All theſe branches, likewiſe, furniſh the integuments.

Arteria Carotis interna. The internal carotid artery having paſſed the great canal of the apophyſis petroſa of the os temporis, ſends off a branch through the ſphenoidal fiſſure to the orbit and eye, and ſoon afterwards another through the foramen opticum by which it communicates with the external carotid. It then runs under the baſis of the brain to the ſide of the infundibulum, and there it commonly divides into an anterior and poſterior branch. The anterior branch runs forward under the brain, and after ſending off ſmall arteries to the olfactory nerves, it divides into two or three branches. The firſt of theſe branches goes to the anterior lobe of the brain; the ſecond to the corpus calloſum, falx of the dura mater, and middle lobe of the brain; the third, which lies between the other two, (and is ſometimes only a diviſion of the ſecond branch) goes to the poſterior lobe of the brain. The poſterior branch, after communicating with the vertebral artery, is ramified on, and between, the ſuperficial circumvolutions of the brain all the way to the bottom of the ſulci. All theſe ramifications are covered by the pia mater, in the duplicature of which they are diſtributed, and form capillary reticular textures in great numbers; and afterwards they are loſt in the inner ſubſtance of the brain. From theſe minute diviſions of the arteries in the pia mater before they enter the brain, it would ſeem as if the pulſe of larger arteries would make too violent an impreſſion on ſo tender and delicate a part.

And perhaps it may be from an increaſe of the impulſe of the arteries in the brain, which ſtrong liquors produce, that the nerves are ſo much interrupted in their functions throughout the whole body, when a man is intoxicated with drinking; and may it not alſo be from a like cauſe that men are delirious in fevers?

Arteriæ cervicales.

Beſides the carotids, the brain has two more, called cervicales, which ariſing from the ſubclavian arteries, (ſee the next chapter), aſcend to the head through the foramina, in the tranſverſe proceſſes of the cervical vertebræ, and into the ſkull through the tenth or great foramen, and pierce the dura mater. Theſe two arteries uniting ſoon after their entrance, give off branches to the cerebellum, and then paſſing forward, divide and communicate with the carotids; and the carotid arteries communicating with each other, there is an entire communication between them all. Theſe are Winſlow's arteriæ vertebrales.

Veins of the head. The veins of the head (as in all other parts of the body) ariſe from the extremities of the arteries, and make up trunks which accompany them, and have the ſame names as the arteries which they accompany. However, to avoid miſtakes, I think it neceſſary here to obſerve, that I ſhall in my deſcription of the veins begin always with the largeſt trunk, or that part neareſt the heart; as the minute diviſions and numberleſs ramifications of the capillary arteries render it very difficult to trace the origin of the veins from where the arteries are reflected. See Chap. i. Sect. 6. Of the Veins in general.

Names of. The veins of the head are the jugulars, and the cervical or vertebral veins; for their origin ſee the next chapter.

Venæ Jugulares externæ. The external jugular veins are ſometimes double from their origins; and when they are ſingle, each of them divides afterwards into two, one anterior, and the other poſterior, or rather ſuperior.

Anterior. The anterior is often a branch of the internal jugular; ſometimes ariſing from the communication of the two jugulars, and ſometimes, but very rarely, from the vena axillaris.

It runs up toward the lateral part of the lower jaw, between the angle and the chin, like a vena maxillaris, and ſends ſeveral branches forwards, backwards, and inwards. Forwards, to the maxillary glands, digaſtric muſcle, muſcles and integuments of the chin and under lip. Backwards, it ſends a ſmall branch a little below the lower jaw, which communicates with the jugularis externa poſterior. Inwards, to the glandulæ ſublinguales, to the tongue called venæ raninæ, to the muſcles of the angles of the lips and neighbouring parts, alſo to the muſcles of the palate, ſeptum palati, amygdalæ, uvula, and to the membrane which lines the arch of the palate. The trunk of the anterior external jugular vein goes from the angle of the lower jaw to the internal angle of the orbit, ſending branches on each ſide to the muſcles and integuments of the face, and takes the name of vena angularis. This trunk ſends off branches to the upper lip, cartilages and part of the noſe, eye-lids and forehead, which laſt is called frontalis; a branch alſo communicates with the ſinuſes of the dura mater, entering the orbit by the orbitary ſinus of the eye.

Poſterior.

The poſterior, or ſuperior external jugular vein, runs up toward the parotid gland, and lower anterior part of the eye, giving out ſeveral conſiderable branches toward each ſide. At its origin a principal branch is ſent out poſteriorly, called vena muſcularis, and a little higher up the vena cervicalis; for which, ſee the next chapter. Backward, it de-

detaches the vena occipitalis, which is diſtributed to the occiput, and ſends a ſmall vein through the poſterior maſtoide hole, which terminates in one of the lateral ſinuſes of the dura mater. It then communicates with the anterior external jugular, under the angle of the lower jaw, and paſſes through the parotid gland, between that angle and the condyle; ſometimes giving off ſeveral branches, which very ſoon unite together, and form areolæ or meſhes, through which the nerves paſs. Afterwards it paſſes before the ear, taking the name of vena temporalis, which is diſtributed to the temples, and lateral parts of the head, towards the occiput and forehead, ſending branches alſo to the temporal muſcle, to the neighbouring parts of the upper jaw, and to the inſide of the lower jaw.

The branches of the external jugular, viz. the anterior and poſterior, all communicate with one another, and with the jugularis interna.

Vena jugularis interna.

The internal jugular vein is the largeſt of all thoſe that go to the head; ſee its origin alſo in the next chapter. This vein detaches a branch up toward the parotid gland, and angle of the lower jaw, where it ſends off branches to the muſcles of the os hyoides, and ſometimes a branch called vena maxillaris. Interna, before mentioned. Another branch is ſent backward to the occiput, communicating with a branch of the vena vertebralis, deſcribed below; and through the poſterior maſtoide hole, with the lateral ſinus of the dura mater. Moſt of theſe branches communicate with the external jugulars.

The vertebral vein proceeds to the foramen occipitale, and communicates with the occipital veins, and occipital ſinuſes of the dura mater. See its origin in the next chapter; this vein ſends branches to the ſmall interior muſcles of the head; and ſometimes a branch enters by the poſterior condyloide hole of the os occipitis, and communicates with the lateral ſinus of the dura mater; but this is not always to be met with.

Vena vertebralis.

The nerves of the head are ten pair, proceeding from the encephalon, as before obſerved, in Chap. i. Sect. 7. Of the Nerves in general.

Nerves of the head.

1. Nervi olfactorii or olfactory nerves, are the firſt pair; and ariſe from the corpora ſtriata of the brain, between the anterior and middle lobes; they run forward on each ſide the criſta galli, till they reach the os cribriforme, into the foramina of which the ſmall filaments inſinuate themſelves, and are immediately ſpread on the membrane which covers the os ſpongioſum, and lines all the internal parts of the noſe. Theſe nerves are the immediate inſtruments of ſmelling. Each olfactory nerve communicates by particular filaments with ſome branches of the nervi ophthalmici and maxillaris ſuperior.

Nervi olfactorii.

2. Nervi optici ariſe ſingle from the eminences of the cerebrum, called thalami nervorum opticorum, and then uniting at the forepart of the cella turcica, they ſeem to be pretty much blended; afterwards they divide, and running obliquely forwards paſs out at their proper hole of the ſphenoide bone, and enter the globe of the eye to be expanded upon the membrana retina. The blood veſſels running through the middle of

Nervi optici.

theſe nerves, and the ramifications of the retina, are very obſervable, whence we may deduce the reaſon of Piccard's experiments of ſuch objects as fall on the entry of the optic nerve being loſt to us, and hence alſo an account may be given of an amauroſis or gutta ſerena.

Nervi motores oculorum.

3. Nervi motores oculorum ariſe at the anterior part of the proceſſus annularis, and going out at the foramen lacerum are diſtributed to the globe of the eye; the muſculus rectus, attollens, adducens, deprimens, and obliquus minor; therefore this pair has juſtly got the name of motores oculi.

Nervi pathetici vel trochleares.

4. Nervi pathetici vel trochleares are the ſmalleſt of any; they ariſe from the anterior lateral part of the proceſſus annularis of the medulla oblongata, and paſſing under the dura mater by the ſides of the cella turcica, they go through the foramina lacera, and are entirely ſpent on the muſculi trochleares, or obliqui majores oculorum, to which muſcles chiefly the rotatory motion of the eyes in ogling, and the advance of the eyes forward in ſtaring and fury, is owing; for which reaſon anatomiſts have called theſe nerves pathetici.

Nervi guſtatorii vel trigemini.

5. Nervi guſtatorii vel trigemini are the biggeſt of the brain; they ariſe from the ſides of the annular proceſs, giving nerves to the dura mater, and after piercing that membrane, divide into three branches, the firſt, called nervus orbitarius vel ophthalmicus, as it is about to enter the orbit by the foramen lacerum, ſends off a ſmall twig that aſſiſts in the formation of the intercoſtal, and then the nerve is diſtributed to the glandula lachrymalis, fat, membranes, and palpebræ of

First branch, or ophthalmicus.

of the eye, while it ſends one conſiderable branch through the orbiter internus anterior hole to be loſt in the membrana narium, and a ſecond paſſes the foramen and ſupercilia to ſupply the muſcles and teguments of the forehead. Hence we eaſily diſcover what part is affected in the megrim (which is a diſeaſe cauſing great pain in the temple and fore-part of the head) when the eye-ball and forehead are racked, and a heat is felt within the noſe. Hence alſo we may learn how the muſcles of reſpiration come to be ſo much affected on the application of any acrid irritating ſubſtance to the membrana narium, as to produce that violent convulſive motion, ſneezing.

Second branch, or maxillaris ſuperior.

The ſecond branch, which may be called maxillaris ſuperior, paſſes out through the foramen rotundum oſſis ſphenoidis, and immediately gives nerves to the fat under the temporal muſcle, and to the palate, ſinus ſphenoidalis, and noſtrils. The remaining trunk inſinuating itſelf into the channel on the top of the antrum Highmorianum (which is a cavity in the maxillary or jaw bone) to which, and to the teeth of the upper jaw it gives ſmall twigs, at laſt comes out at the orbiter externus hole, and is ſpent on the muſculus orbicularis palpebrarum, noſe, and upper lip, where ſome branches of the ſeventh pair ſeem to unite themſelves to the twigs of this.

Third branch, or maxillaris inferior.

The third branch, or maxillaris inferior, goes out at the foramen ovale or fourth hole of the ſphenoidal bone, and ſoon ſplitting into a great many branches is diſtributed to the muſculus temporalis vel crotaphites, maſſeter, pterygoides, digaſtricus, buccinator, mylo-hyoideus, genio-hyoideus, genio-gloſſus, and baſio-gloſſus, glandula ſublingualis, maxillaris inferior, and parotis, to the external ear, where it ſeems to join the portio dura to the ſubſtance of the tongue, in which it is pretty much confounded with the ninth pair: from the root of this laſt branch, the chorda tympani is reflected. The laſt ramification of this branch which I ſhall mention, is that which enters into the canal of the lower jaw, there furniſhing the teeth, and comes out at the chin, on which and the lower lip it is beſtowed; at this place it is again united to the ſeventh pair. From this ſhort ſketch of the large fifth pair of nerves, and by obſerving ſeveral phænomena which happen to thoſe parts to which they are diſtributed, we might have a much farther confirmation of the general doctrine of nerves delivered, and ſee, at leaſt, the way pathed to a rational account of the phænomena, for reaſoning on which we ſhould not otherwiſe have the leaſt ground.

We can, for example, from the chorda tympani and the nerves of the teeth being derived from the ſame common trunk, underſtand how the ſound of any vibrating body held between our teeth is ſenſible to us, when another perſon cannot poſſibly hear it. By the like rule, we know why in a violent tooth-ach, the muſcles of the face are ſometimes convulſed; nor ſhall we be ſurpriſed to hear one plagued with the ach in his upper teeth, complain of a gnawing pain deep ſeated in the bones of his face, or to ſee his eye-lids much ſwelled, or the tears trickling down in great abundance; whereas the lower teeth aching, the ear is pained, and the ſaliva flows in great quantity. We may have a diſtant view of ſome foundation in reaſon for the cure of the tooth-ach by ſtrong compreſſion of the chin, or by applying bliſters behind the ears, or by burning behind or on the ear. Among a great many inſtances of the good effect of the actual cautery in ſuch a caſe, I ſhall give one which ſeems to me remarkable: a man was ſeized with the tooth-ach, and a convulſion of that whole ſide of his face followed whenever the pain became acute, or he attempted to ſpeak; after he had undergone bleeding, purging, ſalivation, ſetons, &c. without any benefit, he was cured by applying a ſmall cauteriſing iron to the antihelix.

Nervi abducentes.

6. Nervi abducentes ariſe from the forepart of the corpora pyramidalia, which are two protuberances of the under part of the cerebellum, ſo called from their reſemblance of a pyramid) and after piercing through the dura mater, they give off a branch, which joined with the reflected twig of the ophthalmic branch of the fifth pair, forms the original of the intercoſtal, and paſſes through the foramen lacerum, to be ſpent entirely on the muſculus adducens oculi. Suppoſing this nerve to ſupply ever ſo little leſs than a due proportion of liquidum nervoſum, an involuntary ſtrabiſmus, or ſquinting, will be occaſioned.

Though the fifth and ſixth pair of nerves form entirely the beginning of the intercoſtal before it goes out of the ſkull, yet becauſe ſeveral other nerves contribute towards the formation of its trunk before it ſends off any branches, I ſhall poſtpone the deſcription of it, till I have ſpoke of the original nerves.

Nervi auditorii.

7. Nervi auditorii ariſe from the ſide of the root of the proceſſus annularis, and entering the meatus auditorius internus, and immediately dividing, one part ſoon loſes its firm coats, and is expanded on the inmoſt camera of the ear, while the other paſſing through the aquæductus Fallopii, comes out of the ſkull involved in all its coats, between the ſtyloide and maſtoide proceſſes; whence we ſee the reaſon of the firſt being named portio mollis, and the other dura. This laſt, after its exit, ſupplies the muſculi obliqui capitis, ſtylo-hyoidei, ſtylo-gloſſi, ſtylo-pharyngæi, and platyſma myoides, on which, and to the ſkin of the neck, a great number of its ſmall filaments run, which are ſometimes cut in opening the jugular vein, whence follows pain at firſt, and a little numbneſs afterwards.

The ſuperior branches of it ſupply the parotid gland, external ear, and whole ſide of the face, as far forwards as the chin. It is ſaid to communicate thrice with the fifth pair, and twice with the ſecond vertebra. Whether may not we hence ſee ſome reaſon why the head is ſo ſoon moved by the impreſſion of ſound on our ear?

Par vagum.

8. Nervi ſympathetici medii, vel par vagum, ariſe from the ſide of the baſis of the corpora olivaria (which are two protuberances of the medulla oblongata, ſo called from their repreſenting an olive in ſhape) where their looſe filamentous texture is very conſpicuous; then running to the hole common to the oſſa temporum and occipitis, they are there joined by the acceſſorius Wil-

liſii, which has its beginning from the two or three ſuperior nerves of the medulla ſpinalis, and mounts upward thither, to paſs out with the par vagum, at that common foramen juſt now mentioned. Very ſoon after they have got out of the cranium, wrapped up in the ſame coat, the acceſſorius ſeparates from its companion, and after paſſing thro' the middle of the muſculus maſtoideus, is loſt in the muſculus trapezius and rhomboides ſcapulæ; while the larger trunk, which, from the great number of branches it ſends off, obtains the name of vagus, runs ſtrait down the neck, near the carotid artery, in its courſe giving ſeveral branches to the larynx. When entered the thorax, it ſplits into two; the anterior ſerves the pericardium, ſends branches to join with thoſe of the intercoſtal that go to the heart, and then on the right ſide turns round the ſubclavian, and on the left round the ductus arterioſus, to mount again upwards at the ſide of the oeſophagus to be loſt in the larynx. This recurrent branch it is that we are earneſtly cautioned to avoid in bronchotomy, though by its deep ſituation we are in no hazard of hurting it. If both theſe nerves were cut, it is probable the voice would not be entirely loſt, as long as the ſuperior branches ſtill ſupply the larynx. The poſterior branch of the eighth pair goes along with the oeſophagus, and ſupplies the lungs, the gula, and ſtomach very plentifully: and as all the nerves beſtowed on the viſcus enter at the ſuperior orifice of it, the ſenſations here muſt be very acute; whence Helmont imagined the mouth of the ſtomach to be the ſeat of the ſoul. What remains of the par vagum is joined to the intercoſtal immediately below the diaphragm.

Par linguale. 9. Nervi hypo-gloſſi externi vel par linguale ariſe from between the corpora pyramidalia and the corpora olivaria; paſſing out of the ſkull through their proper holes of the os occipitis, and after ſending off ſome nerves to the glandula thyroidea, and muſculi ſterno-hyoidei, and ſterno-thyroidei, are loſt in the ſubſtance of the tongue. Authors have diſputed whether this ninth or the fifth is the guſtatory nerve; the old opinion in favour of the ninth is to me moſt probable, becauſe the fifth is no where elſe employed as an organ of ſenſation, and becauſe the ninth ſeems to penetrate the ſubſtance of the tongue more, while the fifth is ſpent on the muſcles.

Nervi ſub-occipitales. 10. Nervi ſub-occipitales ariſe from the beginning of the medulla ſpinalis, betwixt the os occipitis and firſt vertebra colli, and are all, except what goes to the ganglion of the intercoſtal, ſpent on the muſculi obliqui, and extenſores capitis.

The only nerves proceeding from the encephalon not deſcribed, are the reflected branches of the fifth and ſixth pair, which, indeed, are ſo ſmall and pappy, and hid by the carotid artery as they go out with it in its crooked canal, as not to be eaſily traced; but whenever they have eſcaped from the os petroſum, they are joined by branches from the eighth, ninth, tenth pair, and the firſt and ſecond ſpinal, whence the largeſt ganglion of the body is formed, from which the nerve named now intercoſtal goes out to deſcend down the neck with the carotid; ſupplying in its courſe the muſculi flexores of the head and neck, and communicating with the cervical nerves. As the intercoſtal is about to enter the thorax, it again forms a ganglion, from which the nerves to the trachea arteria, and the heart are ſupplied, which join with the branches of the eighth, and paſs between the two large arteries and auricles to the ſubſtance of that muſcle. Now if any one conſider the egreſs of the intercoſtal, and cloſe courſe of it and the eighth with the carotid artery, and this manner of entry of the cardiac nerves, ſurely the alternate conſtriction and relaxation of the heart will appear neceſſarily depending on the diſpoſition of theſe organs of motion, the nerves. The intercoſtal after this runs down on the ſide of the vertebræ thoracis, having additional nerves conſtantly ſent to it from between theſe vertebræ, till it paſſes through its own proper hole of the diaphragm; whence it again forms another ganglion cloſe by the glandulæ renales, into which the eighth pair enter. From ſuch a knot on each ſide, the nerves of the guts, liver, ſpleen, pancreas, and kidneys are derived; nay the extremity of this nerve is ſent down to the pelvis to ſupply the parts there. Hence the great ſympathy of theſe parts may be eaſily deduced, and a reaſon may be given of a violent vomiting that commonly attends a nephrites, and of the belching, colics, and ſtomachachs, which often enſue, on the obſtructions of the menſtrua.

For the above accurate deſcription of the the nerves I am obliged to that moſt ingenious anatomiſt the late profeſſor Monro, from whom the ſubſequent account of all the nerves in particular is alſo extracted throughout the work.

Glands of the head.

The glands of the head remaining now to be deſcribed, are in the exterior part, that is out of the cavity of the ſkull; thoſe of the interior part, viz. the glands of the brain and its membranes, are already ſpoken of.

We have here the parotides, maxillares, ſublinguales, tonſillæ, linguales, labiales, buccales, fauciales, palatinæ, gingivarum, and uvulares; which take their names from their reſpective ſituations, being ſituated in and about the mouth, palate, and tongue, to afford ſaliva in all parts of the mouth to keep it moiſt. Thoſe more remote are chiefly concerned in maſtication. In the orbit alſo there is the lachrymal glands; under the eye-lids are the ceraceous or ſebaceous glands, the mucoſe glands of the pituitary membrane of the noſtrils, and the ceruminoſe glands of the ears.

The largeſt and moſt remarkable are the ſalival glands; the others are ſo ſmall as to render a particular deſcription unneceſſary and of no ſignificance.

Parotis vel maxillaris ſuperior.

Parotis, vel maxillaris ſuperior, is the largeſt of the ſalivary glands; it is ſituate behind the lower jaw, under the ear (on each ſide); from this gland, there runs a very large duct about three fingers breadth long, and of the thickneſs of a wheat-ſtraw, having a great number of roots; this duct, from Steno the diſcoverer, is by ſome called ductus ſalivalis Stenonis; by others ductus ſalivalis ſuperior. It paſſes over the tendinous part of the maſſeter muſcle, (to prevent its being compreſſed by that muſcle, which would obſtruct the ſaliva) through the middle of the cheek, and there perforates the buccinator muſcle and the membrane of the mouth, near the ſecond or third of the dentes molares, and at this perforation it diſcharges a very large quantity of its proper fluid into the mouth.

When this duct is divided by an external wound, the ſaliva will flow out on the cheek, unleſs a convenient perforation be made into the mouth, and then the external wound may be healed.

This gland is one of thoſe that ſerve for the ſecretion of the ſaliva; it has the diſcharge of its ſaliva promoted, by the motions of the lower jaw. When this gland is ulcerated, there is a conſtant effuſion of ſaliva; to cure which Hildanus applied the actual cautery, but if you conſume the greateſt part of the gland with merc. præcipit. rubr. it will heal with little trouble.

Maxillaris inferior

Maxillaris inferior is ſituate between the lower jaw and the tendon of the digaſtric muſcle. Its duct paſſes under the muſculus mylo-hyoideus, and enters the mouth under the tongue, near the dentes inciſorii.

Sublingualis.

Sublingualis is a ſmall gland ſituated under the tongue, (one on each ſide) between the jaw and the cerato-gloſſus muſcle.

Tonſilla.

Tonſilla is a globular gland about the bigneſs of a hazel nut, ſituate upon the pterygoideus internus muſcle, between the root of the tongue and the uvula, on each ſide of the mouth; they are commonly called almonds of the ears, from their reſembling almonds in figure. The tonſilla has no duct continued from it, but empties all its ſmall ducts into a ſinus of its own, which ſinus, when the gland is inflamed, may eaſily be miſtaken for an ulcer. This gland, with its fellow, directs the maſticated aliment into the pharynx, and alſo ſerve for the uvula to ſhut down upon when we breathe through the noſe. They are compreſſed by the tongue and the aliment, when the former raiſes the latter over its root, and thereby opportunely emit their ſaliva to lubricate the food for its eaſier deſcent through the pharynx. A ſchirrous tumor of either of theſe glands is a common diſeaſe, and it admits of no remedy but extirpation; the beſt way of doing which, is by ligature, as directed in my Marine Surgeon, &c.

Preſſure upon the ſurface of a gland very much promoting the ſecretion that is made in it, theſe glands are ſo ſeated as to be preſſed by the lower jaw, and its muſcles, which will be chiefly at the time when their fluid is wanted; and the force with which the jaw muſt be moved, being as the drineſs and hardneſs of the food maſticated, the ſecretion from the glands depending very much upon that force, it will alſo be in proportion to the drineſs and hardneſs of the food, which is neceſſary; for all food, being to be reduced to a pulp, by being broke and mixed with ſaliva before it can be ſwallowed fit for digeſtion, the drier and harder foods needing more of this matter, will from this mechaniſm be ſupplied with more than moiſter foods, in about that proportion in which they are drier and harder; and the drier foods needing more ſaliva than the moiſter, is the reaſon why we can eat leſs, and digeſt leſs, of theſe, than thoſe. What quantity of ſaliva theſe glands can ſeparate from the blood, in a given time, will be hard to determine, but in eating of dry bread, it cannot be leſs than the weight of the bread; and many men, in a little time, can eat more dry bread than twice the ſize of all theſe glands; and ſome, that are not uſed to ſmoaking, can ſpit half a pint in ſmoaking one pipe of tobacco. Some men in a ſalivation have ſpit for days, or weeks together, a gallon in four and twenty hours; and yet, I believe, ſays Cheſelden, (from whom this is extracted) all theſe glands put together, do not weigh more than four ounces.

The glandulæ ſebaceæ are ſituated in the interior ſurface of the eyelids: they ſerve for the ſecretion of an oleaginous fluid, which is of great uſe in preventing the attrition of the eye-lids, from their continual motion. Glandulæ ſebacæ.

The glandula lachrymalis is ſituated in the orbit, above the ſmaller angle, with its excretory ducts under the upper eye-lids. Glandula lachrymalis.

The glandulæ ceruminoſæ are ſmall glands of a yellow colour, ſituate in the convex part of the membrane of the meatus auditorius of the ear, about the middle of the paſſage; they ſerve to ſecrete the cerumen, which they depoſit for various purpoſes in the paſſage. Glandulæ ceruminoſæ.

Glandulæ mucoſæ are ſituated in the pituitary membrane of the noſtrils, and ſeparate that matter which we call mucus. Glandulæ mucoſæ.

C H A P. III.

S E C T. I.

Of the Neck and its Parts.

Neck, parts of.

THE neck in general is divided into the anterior part or throat, and poſterior part or nape; the throat begins by an eminence, and terminates by a foſſula; the nape begins by a foſſula, which as it deſcends is gradually loſt. The neck conſiſts of ſeven bones or vertebræ; a number of muſcles, which ſerve to move the head, neck, larynx, pharynx and the os hyoides; a number of very large arteries, as the internal and external carotids, and the vertebral ones; large veins, as the internal and external jugulars, and the vertebral veins; large nerves, of the par vagum, intercoſtals, recurrent, diaphragmatics and the vertebral; a part of the ſpinal marrow; the aſpera arteria or trachea, particularly the larynx; the pharynx, with part of the oeſophagus; and the thyroide, with ſome other ſmaller glands.

S E C T. II.

Of the Bones of the Neck.

Of the vertebræ in general.

AS the bones of the neck belong alſo to the ſpine (vulgarly called the backbone) I ſhall firſt deſcribe the vertebræ of that bony column in general, then thoſe of the neck in particular. The whole ſpine or chain of bone, from the os occipitis to the os ſacrum, conſiſts of twenty-four vertebræ or joints; each vertebra is diſtinguiſhed into two parts, viz. the body, and its proceſſes.

Body. The body of each vertebra (except the firſt) is ſofter and more ſpongious than the proceſſes, which are harder and more ſolid; the fore-part of the body is round and convex; the hind-part ſomewhat concave; its upper and lower ſides are moſt of them plain, each covered with a cartilage which is pretty thick forwards, but thin backwards, by which means we bend our body forwards; for the cartilages yield to the preſſure of the bodies of the vertebræ, which in that motion come cloſer to one another. This could not be effected, if the harder bodies of the vertebræ were cloſe to one another.

Proceſſes. Each vertebra has three ſorts of proceſſes towards its hinder part, except the firſt; from the hind part of each, ſtands a proceſs named ſpinalis, and from every one a proceſs on each ſide called tranſverſalis, with one ſhort one above it called obliqui ſuperiores, and one ſhort one below it, named obliqui inferiores. By theſe ſhort oblique proceſſes, the vertebræ are articulated; and in each of the tranverſe, there is a tendon of the vertebral muſcles inſerted. Cavities. Theſe proceſſes, with the hinder or concave part of the body of the vertebræ, form a large hole in each vertebra, and all the holes anſwering one another (from the head to the os coccygis), make a channel for the deſcent of the ſpinal marrow, which ſends out its nerves to the ſeveral parts of the body by pairs, thro' two ſmall lateral holes in each ſpace, between the vertebræ formed by the joining of four notches in the ſide of each ſuperior and inferior vertebra.

Situation in particular. Though the ſituation of the vertebræ has been already mentioned pretty exactly, it will be proper to repeat it again. The body is the anterior part of each vertebra; the ſpinal proceſs the poſterior part; the tranſverſe and oblique, or articular proceſſes, are the lateral parts; and the great foramen is in the middle of all theſe parts.

Articulations. The vertebræ are articulated to one another by a ginglymus; for the two inferior oblique proceſſes of all the vertebræ of the neck and back, have a little dimple in their extremities, wherein they receive the extremities of the two ſuperior oblique proceſſes of the inferior vertebræ, ſo that the two ſuperior proceſſes of each vertebra of the neck and back are received, and the two inferior do receive, except the firſt of the neck, and the laſt of the back; but the ſuperior proceſſes of each vertebra of the loins receive, and the two inferior are received, contrary to thoſe of the neck and back. The vertebræ are all tied together by a hard membrane made of ſtrong and large fibres; it covers the body of all the vertebræ forwards, reaching from the firſt of the neck to the os ſacrum. There is another membrane which lines the canal, made by the large hole of each vertebra, which alſo ties them all together; beſides, the bodies of the vertebræ are tied to one another by the intervening cartilages, and the tendons of the vertebral muſcles, which are inſerted in their proceſſes, (as abovementioned) tie them together behind.

From the above account of the articulations of the vertebræ, it is evident their centre of motion is altered in different poſitions of the trunk. For when we bow forwards, the ſuperior moved part, bears entirely on the bodies of the vertebræ; if we bend back, the oblique proceſſes ſupport the weight; if we recline to one ſide, we reſt upon the oblique proceſſes of that ſide, and part of the bodies of the vertebræ; if we ſtand erect, all the bodies and oblique proceſſes have their ſhare in our ſupport. From this ſtructure, the extenſors have about twice the lever to act with, and conſequently, twice the power to raiſe the trunk into an erect poſture, that they have to carry it beyond that poſture; for then, the oblique proceſſes begin to be the centre of motion, and give a like advantage to the benders. Without this contrivance it would be more difficult to keep the body erect, or to recover an erect poſture with conſiderable ſtrength after a bend of the body. If the ſpine had been compoſed all of one bone, we could have had no motion in our backs; or had it been of two or three bones articulated for motion, or even fewer bones or joints than it really is, they muſt have either not been capable of bending ſo much as they do (and been ſo pliable for the ſeveral poſtures we have occaſion to put ourſelves in) or have bent more in each joint, which would have preſſed or bruiſed the ſpinal marrow; the ill conſequences of which are ſufficiently ſeen in perſons grown crooked or who have had diſtortions from external accidents. Again, if the ſpine had been made of ſeveral bones without intervening cartilages, we ſhould have had no more uſe of it than if it had been but one bone. If each vertebra had had its own diſtinct cartilage, it might have been eaſily diſlocated. And laſtly, the oblique proceſſes of each ſuperior and inferior vertebra keep the middle one, that it can neither be thruſt backwards nor forwards, to compreſs the medulla ſpinalis.

It may be obſerved as a general rule, notwithſtanding ſome exceptions, that the bodies of the vertebræ are ſmaller and more ſolid above, but as we reckon downwards, appear larger and more ſpungy, and that the cartilages between them are thick, and the ſurrounding ligaments ſtrong in proportion to the largeneſs of the vertebræ, and the quantity of motion they are to perform: by which diſpoſition the greater weight is ſupported on the broadeſt, beſt ſecured baſe, and the middle part of our body is allowed a large and ſecure motion, which is of conſiderable benefit. Thus much of the vertebræ in general; but becauſe they are not all alike, the reader is referred to their particular deſcription, in the following pages.

Bones of the neck.

The bones of the neck are the ſeven ſuperior vertebræ of the ſpine, already mentioned; theſe vertebræ are ſmaller than thoſe of the back, but they are of a firmer conſiſtence and harder: their body is more compreſſed than in the others, and is ſituated on the other part, and convex below. The breadth on the fore-part increaſes gradually as they deſcend; ſo that the vertebræ of the neck taken all together repreſent a ſort of pyramid. The tranſverſe proceſſes of theſe vertebræ are perforated for the paſſage of the vertebral veſſels to the head: and the acute or ſpinal proceſſes are forked and ſtrait; but beſides this, the firſt and ſecond vertebræ have ſomething peculiar to themſelves.

Atlas. The firſt or upper vertebra is called Atlas, (becauſe it ſupports the head, as king Atlas did the globe of the univerſe, according to antient fable); it has neither body nor ſpinal proceſs, therefore its ſubſtance is more ſolid than that of any other; the foramen or hole in this, is greater than in any other vertebra, which ariſes from its wanting the body, and looks like an irregular bony ring. The upper ſide of this vertebra has two cavities, into which the apophyſes of the os occipitis are received; but theſe two cavities together, unlike all other joints, are laterally portions of concentric circles, by which means they are but as one joint, and ſo ſuffer the head to move eaſily ſide-ways, which otherwiſe it could no more do than the knee, which alſo has two heads and two cavities. The under ſide of this bone has a very flat articulation with the next, which fits it for a rotatory motion. In the fore-part of its great hole it has a pretty large ſinus, in which lies the tooth-like proceſſes of the ſecond vertebra, being faſtened by a ligament that riſes from each ſide of the ſinus, that it compreſs not the medulla ſpinalis; it has two ſmall ſinuſes in its upper part, in which the tenth pair of nerves and the vertebral arteries lie.

Dentata. The ſecond vertebra is called epiſtrophæus, dentata, or axis, from a proceſs which paſſes through the former bone, and is the axis upon which it turns; nevertheleſs all the vertebræ of the neck contribute ſomething to the rotatory motion of the head. The proceſſus dentatus, (which is long and round like a tooth, from whence its name,) is ſituate in the middle, between the two oblique ſuperior proceſſes; it is received into the aforeſaid ſinus of the Atlas, and is ſtrongly tied to the os occipitis, and to the Atlas by ligaments, to prevent its hurting the ſpinal marrow, which accident would prove mortal.

Axis. The third vertebra is alſo called axis by ſome, though it has nothing to warrant ſuch a name; for there is nothing particular to be obſerved in this, or any of the four following vertebræ of the neck, more than has been already taken notice of the vertebræ in general.

The forepart of the ſeven vertebræ of the neck, and two upper of the back, are flat, to make room for the aſpera arteria and gula.

The ſpinal proceſſes of the ſecond, third, fourth, and fifth vertebræ of the neck are forked; the two laſt, long and horizontal; the tranſverſe proceſſes are perforated, for the admiſſion of the cervical blood-veſſels, and bowed downwards, and hollowed, for the paſſage of the cervical nerves. The oblique proceſſes of the received bone are wrapped over thoſe of the receiving bone, which prevents their luxating forwards; the tranſverſe proceſſes, with a ſmall apophyſis of the body of the ſame bone, in like manner, ſecure them from ſlipping backwards; and an apophyſis on each ſide of the body of the receiving bone hinders them from ſlipping to either ſide. Luxations in this chain of bones are far worſe than any other, becauſe of the ſpinal marrow which it contains. The uppermoſt vertebra of the neck being fixed behind the center of gravity of the head, the neck is therefore ſo far bent forward, as that the laſt of theſe vertebræ (which has a firm bearing upon thoſe of the thorax) may be exactly under the centre of gravity.

SECT. III.

Of the CARTILAGES, LIGAMENTS, &c. of the NECK.

Cartilages of the vertebræ in general.

THE cartilages of all the vertebræ in general are of two kinds, one proper to each vertebra, the other common to the two vertebræ that lie next each other. The firſt I term cartilages of articulation, the others, cartilages of ſymphyſis. The proper articular cartilages of each vertebra of the whole ſpine are thoſe four which cover the ſurfaces of the four ſmall oblique or articular apophyſes. In the firſt vertebra of the neck and vertebræ of the loins, theſe cartilages are thicker than the reſt. Sometimes we find moveable or inter-articular cartilages between the apophyſes of the Atlas and dentata. The firſt vertebra of the neck has a ſmall cartilaginous incruſtation in the middle of the concave ſide of its anterior arch, anſwering to another on the foreſide of the odontoide apophyſis of the ſecond vertebra, ſo that theſe two vertebræ have each five articular cartilages, beſides the inter-articular ones already mentioned.

The cartilages of ſymphyſis lie between the bodies of the vertebræ, one of them being contained between, and cloſely joined to the lower ſurface of the body of one vertebra,

bra, and to the upper ſurface of that next under the former; their height and thickneſs is different in each claſs of the vertebræ; thoſe of the neck are not ſo thick as thoſe of the loins, nor ſo thin as thoſe of the vertebræ of the back; nor are the cartilages of an equal thickneſs in all their parts. Thoſe of the neck and loins appear to be the thickeſt on the fore-ſide, and thoſe of the back rather thickeſt on the back-ſide; but theſe differences are moſt remarkable in the vertebræ that lie near the middle of each claſs. The internal ſtructure of theſe cartilages is different from that of all other cartilages of the body, and, indeed, they reſemble the reſt in nothing but in whiteneſs and elaſticity; for they are made up of a great number of cartilaginous, horizontal, concentrical rings contained within each other, a ſmall diſtance being left between them. They are cloſeſt and thinneſt near the center, and about the middle ſeem to degenerate into another ſofter kind of ſubſtance. The interſtices between the rings are filled with a mucilaginous ſubſtance, leſs fluid than that of the joints. All theſe cartilages yield to compreſſion, (and in inflexions of the ſpine, the external ſurface of the cartilage jets out on that ſide toward which the inflexion is made); they reſtore themſelves afterwards, by being freed from compreſſion; ſo that a man is really taller after lying ſome time, than after he has walked or carried a burden for a great while; owing to the different ſtate of the inter-vertebral cartilages.

Ligaments of the vertebræ in general.

All the vertebræ are ſtrongly connected to each other by ligaments, which are very ſhort and ſtrong; they croſs each other obliquely,

liquely, and are fixed round the edges of the body of each vertebra. Theſe crucial ligaments cover the circumference of the intervertebral cartilages, and adhere cloſely to them. Beſides this, the firſt vertebra is fixed to the os occipitis, by a peculiar kind of ligament, which is fixed above round the great occipital foramen and below round the vertebra.

The ſecond vertebra has two peculiar ligaments; one of which connects the proceſſus dentatus to the os occipitis, and may be termed the occipital ligament of the odontoide apophyſis; the other confines this apophyſis within the anterior portion of the cavity of the firſt vertebra, and is named the tranſverſe ligament. It belongs more properly to the firſt vertebra.

All the vertebræ are likewiſe ſtrongly connected by a ligamentary tube, which lines the inner ſurface of the medullary canal, repreſenting a long flexible funnel, its cavity at the upper part being equal to that of the occipital foramen, and ending in a ſmall point at the os ſacrum. The articular ligaments of the ſpina dorſi are thoſe which tie the glenoide cavities of the Atlas to the condyles of the os occipitis; thoſe that join the cartilaginous ſurface of the apophyſis dentiformis to the anterior cavity of the firſt vertebra, and thoſe by which all the oblique or articular apophyſes are connected together. Theſe are all ſmall, ſhort, ſtrong ligaments, fixed by both extremities round the cartilaginous ſurfaces of the apophyſes, ſurrounding very cloſely all the capſular ligaments of theſe articulations before mentioned. The membranous ligaments of any ſignification are deſcribed with the muſcles; as are the cartilages of the larynx, &c. and ſee Chap. i. Sect. 3. for a univerſal deſcription of both.

Mucilaginous glands of the vertebræ in general. The mucilaginous glands of all theſe articulations are very ſmall, but are accompanied by many fatty moleculæ lying round each joint. The inner ſurface of the ligamentary tube above-mentioned, is lubricated by an oily or adipoſe ſubſtance, which is ſpoken of already in Chap. ii. Sect. 6.

SECT. IV.

Of the Muscles of the Neck.

Muſcles of the head and neck. BIventer cervicalis ariſes from the tranſverſe proceſſes of the ſeven ſuperior dorſal vertebræ, and is inſerted with the complexus into the back part of the os occipitis, at the ſide of its middle, a little lower than where the cucullaris begins.

Complexus. Complexus is a broad and pretty long muſcle, ſituate along the back-part and ſide of the neck; it ariſes from the three ſuperior dorſal vertebræ, and the ſix inferior vertebræ of the neck, and is inſerted with the former into the os occipitis, and back-part of the os temporis. This laſt part is ſometimes diſtinct enough to be accounted another muſcle. It pulls the head and neck back.

Maſtoideus. Maſtoideus is ſituate obliquely between the back-part of the ear, and lower part of the throat; it is in a manner compoſed of two muſcles, (which Albinus terms ſterno-maſtoideus, and cleido-maſtoideus,) though in fact but one: it ariſes tendinous from the ſternum near the clavicula, and by a ſeparate fleſhy portion from the clavicula near its articulation with the ſternum. The two portions ſoon unite together, and is inſerted into the outer part of the proceſſus maſtoideus of the os temporis; over this proceſs, it ſends off a very broad aponeuroſis, which covers the ſplenius, and is inſerted in the os occipitis. It pulls that ſide of the head it is inſerted into, towards the ſternum, and turns the face towards the contrary ſhoulder; this muſcle, with its fellow, pulls the head and neck toward the breaſt, but acts with more force on the joints of the neck, than upon the head.

Trachelo-maſtoideus.

Trachelo-maſtoideus ariſes from the tranſverſe proceſs of the firſt and ſecond vertebræ of the back, and from the three or four lowermoſt of the neck, by ſo many thin tendons, which, uniting, form a pretty thick fleſhy belly, that runs up under the ſplenius, and is inſerted into the middle of the backſide of the proceſſus maſtoideus by a thin tendon.

Splenius capitis.

Splenius capitis ariſes from the ſpinal proceſſes of the five lower vertebræ of the neck, and the five upper ones of the back, and alſo the linea alba colli. It is inſerted into the os occipitis a little above the maſtoide proceſs of the temporal bone, and the tranſverſe proceſſes of the three ſuperior vertebræ of the neck.

This muſcle pulls the head and neck backward, and to the contrary ſide; but both of them acting together, pull them directly backward.

Rectus internus major.

Rectus capitis internus major is already deſcribed with the muſcles of the head, to which the reader is referred.

Muſcles of the neck. The above muſcles ſerve both the head and neck conjointly; thoſe only peculiar to, and which are properly called muſcles of the neck, are as follows:

Interſpinales cervicis. Interſpinales cervicis are muſcles ariſing from the ſuperior parts of each bifid or double ſpinal proceſs of the cervical vertebræ, and inſerted into the inferior parts of the ſame. When theſe muſcles act, they bend the neck backward, drawing the ſpines of the vertebræ nearer each other.

Intertranſverſales cervicis. Intertranſverſales cervicis are ſituate between the tranſverſe proceſs of the vertebræ of the neck, like the interſpinales, but not ſo diſtinct; they draw theſe proceſſes together. They ariſe from the lower vertebra, and are inſerted into that next above: theſe Douglas terms intervertebrales.

Spinalis cervicis. Spinalis cervicis ariſes from the tranſverſe proceſſes of the five ſuperior vertebræ of the back, and is inſerted into the ſpinal proceſſes of the ſecond, third, fourth, and fifth vertebræ of the neck. This pulls the neck backward.

Tranſverſalis cervicis. Tranſverſalis vel ſemiſpinalis cervicis ariſes from the oblique proceſſes of the four inferior vertebræ of the neck, and is inſerted into the ſpinal proceſs of the ſecond vertebra of the neck. This muſcle is but a continuation of the tranſverſalis or ſemiſpinalis dorſi; it moves the neck obliquely backwards, as when we look over the ſhoulder.

Longus colli. Longus colli ariſes laterally from the bodies of the four ſuperior vertebræ of the back, and from the anterior part of the tranſverſe proceſſes of the five inferior vertebræ of the neck, and is inſerted into the fore-part of the firſt and ſecond vertebræ of the neck, which it bends forward.

Splenius colli ariſes from the ſpinal proceſſes of the ninth and tenth vertebræ of the back, and is inſerted into the tranſverſe proceſſes of the fifth, ſixth and ſeventh vertebræ of the neck. Splenius colli.

For the reſt of the muſcles of the neck, viz. cervicalis deſcendens vel ſacro lumbaris, elevator ſcapulæ, and ſcalenus, ſee the muſcles of the thorax and abdomen in the next chapter: for the latiſſimus colli, ſee platyſma myoides.

The muſcles of the head and neck are moſt of them obliquely directed; therefore, they perform the oblique motions, as well as extenſion and flexion; and acting by pairs they move the head and neck ſteadily, in a diagonal direction, which ſtrait muſcles could not have done ſo well.

The aſpera vel trachea arteria, or windpipe, is a canal ſituated in the forepart of the neck, by which we draw in the air, &c. it being extended from the mouth to the lungs. See its deſcription in the next chapter.

The larynx is the thick, upper part of the aſpera arteria, or wind-pipe; it is principally compoſed of five cartilages. The firſt is the thyroide, or ſcutiform cartilage, which is of a kind of quadrangular figure, and ſtands in the anterior part; this is the largeſt of the five; in the forepart of this cartilage is the protuberance called pomum Adami. The ſecond is the cricoide, or annular cartilage; this occupies the lower part by way of baſe to the reſt, and to the loweſt part of this what is properly called the aſpera arteria adheres. The third and fourth cartilages are Larynx. Cartilages of.

the two arytænoide ones; theſe form, as it were, a kind of baſon of a ſingular figure, which is joined to the poſterior and ſuperior parts of the cricoides, by particular articulations on each ſide, that the glottis (which is the mouth, chink, or rimula, of the larynx,) may be more eaſily opened and contracted. Between the arytenoides and ſides of the thyroides, there are two ſmall cavities on each ſide; in which if a little drink or bread fall, (as ſometimes happens, when one laughs, or ſpeaks, in eating or drinking,) it cauſes a violent cough, and a great tickling. The fifth and laſt cartilage (which is ſofter than the reſt) is the epiglottis; its uſe is to cover the glottis in eating and drinking; for the aliments, by their own weight, preſs it cloſer down upon the glottis, and they paſs over without entering the larynx, into the œſophagus or gullet: but when the aliments are paſſed, the epiglottis, by its natural action, (which is common to all cartilages) lifts up again, and gives way to the air in breathing. While we ſpeak, or laugh, the glottis muſt neceſſarily be opened for the paſſage of the air in breathing; therefore it is not convenient to ſpeak while we ſwallow.

Membrane of the larynx.

The membrane which inveſts the larynx, is very ſenſible, and is furniſhed with a number of oſcula or openings, which diſcharge a lubricating fluid. Ruyſch and Morgagni diſcovered, that there were alſo glands extended over each ſurface of it, which, ſay they, ſerve for ſecreting a mucous fluid, for lubricating the whole aſpera arteria; but theſe are often ſo ſmall, that they are ſcarce diſcoverable in diſſection.

Ventricles of the larynx.

The ventricles of the larynx are certain hollows, ſome of them ſmaller, ſome larger; they are on the inſide of it, under the glottis, and ſerve to modulate the voice. Theſe, with the dilatation, and ſtraitening of the muſcles and cartilages of the glottis, give that wonderful variety of notes, of which the voice is capable, in ſpeaking and ſinging.

Muſcles of the larynx.

The muſcles of the larynx, with its glottis and epiglottis, are the following.

Sterno-thyroideus.

Sterno-thyroideus ariſes from the upper and inſide of the ſternum, and aſcending on the ſides of the trachea, is inſerted into the lower part of the ſides of the cartilago ſcutiformis vel thyroides, to pull it downward.

Hyo-thyroideus vel cerato-thyroideus.

Hyo-thyroideus vel cerato-thyroideus ariſes from the lower part of the baſis, and the horn of the os hyoides, and deſcending, is inſerted in the lower part of the cartilago ſcutiformis, near the former to pull it upward.

Crico-thyroideus.

Crico-thyroideus ariſes from the anterior part of the cartilago cricoides, and running under the thyroide cartilage, is inſerted into its inſide, which it pulls towards the cricoides, and ſerves occaſionally either to dilate, or conſtringe the glottis.

Crico arytænoideus, lateralis.

Crico-arytænoideus lateralis ariſes from the lateral part of the cartilago cricoides, and aſcending, is inſerted into the lateral part of the arytænoides; this, with its fellow, ſerves to dilate the rimula or glottis.

Crico-arytænoideus poſticus.

Crico-arytænoideus poſticus ariſes from the back-part of the cartilago cricoides, and is inſerted into the arytænoides, near the former, to pull it backward, and dilate the glottis.

Thyro-arytænoideus. Thyro-arytænoideus ariſes from the ſuperior, middle, internal, and concave ſide of the ſcutiform, and is inſerted into the fore-part of the arytænoide cartilage; it ſerves, together with the following muſcle, to conſtringe the rimula or glottis.

Arytænoideus. Arytænoideus is one ſingle muſcle, (tho' Winſlow and Douglas divide it into two or three,) which ariſes from one arytænoidal cartilage, runs upon the upper part, and is inſerted into the other which forms a ſphincter for contracting the rimula and ſhutting the glottis.

Muſcles of the epiglottis. The epiglottis has three ſmall muſcles, which occaſion it to cover the glottis (or aperture of the larynx) in the act of ſwallowing, and prevent any thing getting into it; they are the thyro-epiglotticus, the arytæno-epiglotticus, and the hyo-epiglotticus: but as theſe are ſo very minute, and their uſe being already mentioned, I ſhall avoid any further deſcription here.

The œſophagus, gula or gullet, is a canal reaching from the fauces to the ſtomach, and conveys into it the food taken in at the mouth. It is ſituate behind the trachea arteria, and before the vertebræ of the neck and back, from near the middle of the neck down to the lower part of the thorax, &c. See its deſcription in the next chapter.

Muſcles of the pharynx. The pharynx is the upper part of the œſophagus next the mouth, in which are a number of glands ſituated, and excretory oſcula, or openings, are frequently diſcovered with them: the muſcles of the pharynx ſerve to open and ſhut the œſophagus, and are as follow.

Stylo-pharingæus ariſes from the beginning of the proceſſus ſtyloides and is inſerted on both ſides into this, and into the thyroide proceſs: this muſcle, with its fellow, ſerves to elevate as well as dilate the pharynx to receive the aliment.

Stylo-pharingæus.

Pterygo-pharingæus, ſpheno vel ſalpingo-pharingæus, ariſes from the inner wing of the os ſphenoides or os cuneiforme, and is inſerted partly in the pterygoide apophyſis, and partly into the cartilaginous portion of the tuba Euſtachiana. Its uſe is to dilate the pharynx, and draw the middle part of it upwards.

Pterygo-pharingæus.

Oeſophagus, vel conſtrictor pharingei, ariſes like a wing from ſeveral parts of the ſkull, tongue, os hyoides, the cricoide and thyroide cartilages, and is inſerted into the back-part of the pharynx, which it draws to the fore-part, and not only conſtringes the pharynx for preſſing down the aliment, but alſo compreſſes the tonſillæ, which ſend out their liquor to lubricate the aliment, whereby it glides the more eaſily down into the ſtomach.

Oeſophagus, vel conſtrictor pharingei.

Palato-pharingæus ariſes from the aponeuroſis of the circumflexus palati, and is inſerted into the ſtylo-pharingæus above mentioned; this muſcle more properly belongs to the palate.

Palato-pharingæus.

Winſlow and ſome others make many ſubdiviſions of theſe muſcles, and give them peculiar names, which I think unneceſſary.

SECT. V.

Of the ARTERIES, VEINS, NERVES, and GLANDS of the NECK.

Arteries of the neck.

THE arteries of the neck are the vertebral arteries, and the internal and external carotids; and their branches are called by the names of the parts they are beſtowed upon as laryngeæ, pharyngeæ, &c.

Arteriæ carotides.

The carotid arteries are two in number, one called the right carotid, the other the left. They ariſe near each other, from the curvature, or arch of the aorta, the left immediately; the right moſt commonly from the trunk of the ſubclavia on the ſame ſide, as has been already obſerved. They run upon each ſide of the trachea arteria, between it and the internal jugular vein, as high as the larynx, without any ramification. During this courſe, therefore, they may be named carotid trunks, or general, common, and original carotids; each of theſe trunks is afterwards ramified in the following manner.

The trunk having reached as high as the larynx, divides into two large branches, or particular carotids, one named external, the other internal.

The external carotid is anterior, the internal poſterior; and the external is even ſituated more inward and nearer the larynx than the other; but the common names may ſtill be retained, as being taken not from their ſituation, but from their diſtribution.

Arteria carotis externa.

The external carotid is the ſmalleſt, and yet appears by its direction to be a continuation of the common trunk; its branches may be divided into anterior or internal, and poſterior or external.

The firſt anterior or internal branch goes out from the very origin of the carotid on the inſide, and ſends off branches to the jugular glands, fat and ſkin, glandulæ thyroideæ, muſcles, and other parts of the larynx, therefore termed laryngeæ; it likewiſe ſends ſome twigs to the pharynx.

The third anterior branch, or arteria maxillaris inferior, goes to the maſtoide muſcle, the ſmall flexors of the head, and muſcles of the pharynx, and alſo to other parts abovementioned.

The other branches, ſupplying the head and its parts, are already mentioned in Chap. II.

Arteria carotis interna.

The internal carotid artery leaving the general trunk, paſſes behind the external carotid, ſituated a little more backward, and generally runs up without any ramification, as high as the lower orifice of the great canal of the apophyſis petroſa of the os temporis; therefore ſends no branches to the neck.

Arteria vertebralis.

The vertebral artery ariſes from the poſterior and upper ſide of the ſubclavian; it runs up through all the holes in the tranſverſe apophyſes of the vertebræ of the neck, and in its paſſage ſends off branches to the aſpera arteria, œſophagus, muſcles of the pharynx, larynx, jugular glands, and all the muſcles and integuments of the neck, which take their names from the ſeveral parts they are beſtowed on, as before mentioned. For their diſtribution in the head, ſee arteriæ cervicales.

Veins of the neck.

The veins of the neck are the internal and external jugulars, and the vertebral veins, which all ariſe from the ſubclavians.

Venæ jugulares externæ.

The external jugular veins are ſometimes double from their origins; and when they are ſingle, each of them divides afterwards into two; one anterior, and the other poſterior or rather ſuperior.

Anterior.

The anterior external jugular (in its paſſage) ſends branches to the muſcles of the larynx and to part of the maſtoideus; beſides thoſe ſent to the head and its parts.

Poſterior.

The poſterior external jugular, a little higher up than its origin, gives off the vena cervicalis which goes to the vertebral muſcles of the neck. Near the cervical vein, but a little more outward ſometimes ariſes the ſmall vena cephalica, which runs down between the pectoral and deltoide muſcles, and unites with the cephalic vein of the arm, which ſhall be deſcribed hereafter. Both the anterior and poſterior external jugular run up the neck, between the integuments and the muſculus maſtoidæus.

Vena jugularis interna.

The internal jugular vein is the largeſt of all thoſe that go to the neck. It runs up behind the maſtoideus and coraco-hyoideus which it croſſes; along the ſides of the vertebræ of the neck, by the edge of the longus colli, to the foſſula of the foramen lacerum of the baſis cranii. In its paſſage, it firſt ſends off ſmall branches to the thyroide glands, then the vena gutturalis which goes to the thyroide gland, larynx, and neighbouring muſcles.

Vena vertebralis.

The vertebral vein ariſes poſteriorly from the ſubclavian or axillaris, ſometimes by two ſtems, ſometimes by one, which ſoon afterwards divides into two. The firſt and principal ſtem gives out the vena cervicalis to the neighbouring muſcles, and then runs up through the holes of the tranſverſe apophyſes of the vertebræ colli. The other ſtem runs up on the ſide of the vertebræ, and communicates with the firſt, running in between the tranſverſe apophyſes of the fourth and fifth vertebra. Thus the vertebral vein accompanies the vertebral artery ſometimes in one trunk, ſometimes in ſeveral ſtems, thro' all the holes of the tranſverſe apophyſes of the vertebræ, all the way to the great foramen occipitale, communicating with the occipital veins, and ſmall occipital ſinuſes of the dura mater. Theſe veins, as they paſs, ſupply the muſcles of the neck, and great canal of the ſpinal marrow, where they form ſinuſes, which communicate with thoſe on the other ſide.

Theſe ſinuſes are pretty numerous, placed one above another all the way to the occiput, communicating with one another, and at laſt with the occipital ſinuſes of the dura mater. See vena vertebralis.

Nerves of the neck.

The nerves of the neck proceed from the medulla ſpinalis, and are ſeven pair; though by ſome reckoned eight, as before obſerved.

1ſt. Pair.

The firſt cervical goes out between the firſt and ſecond vertebræ, and, after ſending off branches that communicate with the tenth and ſecond vertebral, is ſpent on the muſculus flexus colli, ſplenius, complexus, and teguments of the occipitis.

2d Pair.

The ſecond cervical communicates with the ninth, and with the firſt and third of the neck, and then is diſtributed to the teguments of the neck and ſide of the head, and to the glandula parotis and external ear, where it joins with the portio dura.

3d Pair. The third of the neck paſſes out between the third and fourth vertebra, ſoon communicating with the ſecond, and ſending down a large branch, which being joined by another from the fourth pair, forms the phrenic nerve that runs along the pericardium to be loſt in the diaphragm. In this courſe the right phrenic is obliged to make a ſmall turn round that part of the pericardium which covers the apex of the heart. Hence it is that ſuch as have ſtrong palpitations of the heart, feel a pungent acute pain immediately above the right orifice of the ſtomach. The other branches of this third cervical are diſtributed to the muſculus trapezius and deltoides, and to the teguments on the top of the ſhoulder; which, with the deſcription of the eighth pair, leads us evidently to the reaſons of the divine Hippocrates's obſervation, that an inflammation of the liver is generally attended with a hiccup, and a ſuppuration of that viſcus with a violent pain on the top of the ſhoulder. However we are not hence to conclude ſo generally as I have obſerved phyſicians frequently do, that if the hippochondria are affected, and this pain of the ſhoulder is felt, therefore the liver is ſuppurated; for any other cauſe ſtimulating or ſtretching the nerves, ſuch as inflammation, wounds, ſchirrhous or ſteatomatous tumors, &c. may produce the ſame effect.

4th Pair. The fourth cervical, after ſending off that branch which joins with the third, to form the phrenic, runs ſtrait to the axilla, where it meets with the fifth, ſixth, and ſeventh cervicals, and firſt dorſal that eſcape in the inter-

5th, 6th, and 7th Pair.

interſtices of the muſculi ſcaleni; and all of them are ſo often conjoined and blended, after they have given off nerves to the muſcles of the neck, ſcapula, arm, and thorax, and to the teguments, that when the ſeveral ramifications go off in the axilla to the different parts of the ſuperior extremity, it is impoſſible to determine which of them the branch belongs to. The conſiderable branches into which they are divided, are ſix; but as they properly belong to the hand and arm, they are deſcribed in the account of theſe parts.

Glands of the neck.

The principal gland of the neck is the thyroides; beſides which there are alſo found in the neck a great number of leſſer ones, diſtributed here and there among the muſcles and fat, and by the ſides of the carotid arteries and internal jugular veins. Their figure, number, and ſituations, vary in different ſubjects; but in general, thoſe in the anterior part of the neck are called jugulars; and thoſe in the hinder part, occipitales and cervicales. The uſe of theſe is hitherto uncertain; it is generally ſuppoſed that they are of ſervice to the lymphatic veſſels, (whence the name of lymphatic glands) but what uſe they can be of to them, does not ſo eaſily appear.

Glandulæ thyroideæ.

Glandulæ thyroideæ are two lymphatic glands, in figure reſembling the new moon, fixed by its middle on the firſt or upper ring of the trachea, with its points or horns turned upwards. It adheres on each part to the larynx and œſophagus. Their colour is red; and they have arteries, veins, and nerves, as the larynx. Theſe glands ſecrete a lubricating fluid, which moiſtens the cartilages and muſcles of the larynx. Ruyſch and Morgagni have alſo deſcribed and figured glands in the epiglottis; and Morgagni has deſcribed others in the other parts of the larynx, particularly about the arytænoide cartilages, as alſo in the trachea: but theſe are often ſo ſmall, (as before obſerved) that they are ſcarce diſcoverable in diſſection.

The œſophagus, eſpecially towards its upper part, has a great number of glands; and it is common to find a little aperture or oſculum, in the centre of each, which has much the appearance of an excretory duct.

CHAP. IV.

SECT. I.

Of the THORAX and its PARTS.

Thorax and its parts.

THE thorax is that large part of the body ſituated between the abdomen and the neck, and anſwers to the extent of the ſternum, ribs, and vertebræ of the back, both outwardly and inwardly.

The anterior part is commonly called the breaſt; the poſterior part, the back; and the lateral parts, the right and left ſides. The large cavity of the thorax was by the ancients termed the middle venter, but the moderns name it ſimply the cavity of the breaſt. This cavity is lined by a membrane named pleura, and divided into lateral cavities by a membranous ſeptum, named mediaſtinum, which is a production or duplicature of the pleura.

The parts contained in it are the heart, pericardium, trunk of the aorta, trunks of the carotid arteries, ſubclavian arteries, trunks of the vertebral and axillary arteries, the ſuperior portion of the deſcending aorta, the intercoſtal arteries, the vena cava ſuperior, vena azygos, ſubclavian veins, trunks of the jugular, vertebral, and axillary veins, a portion of the aſpera arteria, the greater part of the œſophagus, the ductus lacteus, or thoracicus, the lungs, pulmonary artery, pulmonary veins, and nerves of the ſeveral parts.

The cavity of the thorax is terminated downward by the diaphragm, which ſeparates it from the abdomen. The heart and lungs are properly the viſcera of the thorax, and are therefore deſcribed under that head.

SECT. II.

Of the Bones of the Thorax.

Bones of the thorax.

THE bones of the thorax are the twelve ſuperior vertebræ of the back, (from the laſt vertebra of the neck downward,) the ribs, and the ſternum. The claviculæ and ſcapulæ belonging properly to the upper extremities are there deſcribed.

Vertebræ of the ſpine.

The whole ſpine (as before obſerved) conſiſts of twenty-four vertebræ; thoſe of the neck are already ſpoken of; the next twelve of the ſpine, belong to the thorax, to theſe the ribs are articulated. See a General Deſcription of the Vertebræ, in Chap. iii. Sect. 2.

The twelve vertebræ of the thorax, or back, differ from the reſt in this, that they are larger than thoſe of the neck, and ſmaller than thoſe of the loins; their acute proceſſes ſlope downwards upon one another; they have in each ſide of their bodies a ſmall depreſſion, wherein they receive the round extremities of the ribs, and another in their tranſverſe proceſſes which receive the little tubercle near that extremity of the ribs. The articulation of the twelfth vertebra of the thorax, with the firſt of the loins is by arthrodia; for both its aſcending and deſcending oblique proceſſes are received. The twelve vertebræ of the back have the leaſt motion of any, becauſe their cartilages are thin, their acute proceſſes are long, and very near to one another; and they are fixed to the ribs, which neither move forwards nor backwards. They are bent backwards, behind the center of motion to make room for the parts contained in the thorax; and that they might not be made too weak by this ſtructure, they are formed for leſs motion than other vertebræ; and thoſe in particular which are bent fartheſt from the center of gravity have the leaſt motion. The forepart of the two upper vertebræ of the thorax are flat forwards, as thoſe of the neck, to make room for the aſpera arteria and gula: the third and fourth vertebræ are acute, to give way to the veſſels of the lungs and heart, and bent to the right ſide, for the better ſituation of the heart, which makes that ſide of the breaſt more convex than the other, and therefore ſtronger; which ſeems advantageous to the right arm, its motions depending upon the ſupport it receives from the breaſt. Hence (ſays Cheſelden, from whom this is taken) I think, it ſeems, that the almoſt univerſal preference of that arm is not an arbitrary thing, but founded upon obſervation, that it is capable of more perfect actions than the other.

The vertebræ of the back are hindered from diſlocating forwards by the ſame proviſion with thoſe of the neck; and from luxating backwards by the ribs, which are faſtened to the tranſverſe proceſſes of the inferior vertebræ, and againſt the back part of the body of the next ſuperior; they alſo hinder them from diſlocating to either ſide; but the laſt ribs are not fixed to the tranſverſe proceſſes of the vertebræ of the thorax, and therefore it is that luxations are moſt frequently ſeen in this part; but the vertebræ of the loins are received into deep cavities, and are tied with much ſtronger ligaments for their ſecurity.

Of a crooked ſpine or bunch-back.

If the vertebræ of the back ſtick out, ſuch as have this deformity are ſaid to be bunch-backed; and in ſuch, the cartilages which are between the vertebræ are very thin and hard forwards, but conſiderably thick backwards, where the oblique proceſſes of the ſuperior and inferior vertebræ are at a conſiderable diſtance from one another, which diſtance is filled up with a viſcous ſubſtance.

This inequality of the thickneſs of the cartilages happens either by a relaxation or weakneſs of the ligaments and muſcles, which are faſtened to the back-ſide of the vertebræ, in which caſe their antagoniſts finding no oppoſition, remain in a continual contraction, and conſequently there can be no motion in theſe vertebræ. If this deformity has been from the womb, the bones being at that time ſoft and tender, the bodies of the vertebræ partake of the ſame inequality as the cartilages. If the bunch be towards one ſhoulder, for example toward the right, then the cartilages on that ſide are very thick, but thin and dry on the other ſide; on the left ſide the oblique apophyſes come cloſe together, but on the right there is a conſiderable diſtance betwixt them, and the ligaments and muſcles are greatly extended on the right ſide, but thoſe on the left are much contracted. If the vertebræ are diſtorted inwards, all things have a different face: the cartilages, and ſometimes the vertebræ, are very thick forwards, but very thin and hard backwards: the acute and oblique proceſſes are very cloſe to one another, and the ligaments upon the bodies of the vertebræ are greatly relaxed, but the muſcles and ligaments which tie the proceſſes together are very much contracted. Theſe diſtortions ſeldom happen in the vertebræ of the loins; but ſuch as are ſo miſerable, have little or no motion of their back.

Sternum. The ſternum, or breaſt-bone, is generally compoſed of three ſpongy bones, ſometimes more; in the upper part of this bone, on each ſide, the clavicles are articulated; the middle part is narrow, the lower part broad; to the end of this, adheres a cartilage called from its figure, cartilago enſiformis vel xiphoides, which is uſually ſingle; ſometimes it is double, and bifurcated, and not unfrequently bony throughout. There is alſo frequently found a variety in the form of the cartilages which join the ribs and ſternum, ſometimes one cartilage ſerving two ribs, and ſometimes a cartilage not joined to any rib; frequently in old perſons we find parts of them oſſified. On each ſide of the ſternum, there are ſeven cavities for the articulation of the ſeven true ribs, to which their cartilages are fixed. The ſternum ſerves to form the anterior part of the breaſt, to ſupport the ribs and clavicles, and to defend the parts contained in the cavity of the breaſt: it alſo ſerves for the inſertion of the mediaſtinum, and for the ſuſtaining the heart itſelf and ſeveral muſcles.

Coſtæ or ribs.

Coſtæ, or ribs, are twenty-four in number, twelve on each ſide; the middle ribs are the largeſt: all the ribs are harder, rounder, and more incurvated towards their articulations with the vertebræ, than at the other extremity towards the ſternum, which is thinner, broader, and more ſpongy. The ribs are diſtinguiſhed into true and ſpurious; the true ribs are the ſeven upper pair, ſo called, becauſe their cartilages reach the ſternum; the ſpurious, or baſtard ribs, are the five loweſt pair, ſo called, as being ſmaller, ſhorter, and more cartilaginous than the reſt, and not reaching ſo far as the ſternum, which makes their articulations very lax, in regard they terminate in long, ſoft cartilages, which, bending upwards, are joined to the upper ribs. On the inſide of the middle ribs, runs a pretty deep ſinus, or channel, for the paſſage of the intercoſtal veſſels, reaching from the end next the ſpine, almoſt to its juncture with the cartilage. In the anterior extremities, the cartilages of the ſeven true ribs are all joined to the ſternum; the eighth, ninth, and ſometimes the tenth, cohere either with the ſternum, or mutually adhere to one another, by means of their tranſverſe cartilages. The anterior extremities of all the others, are looſe and free, between the muſcles of the abdomen and the diaphragm.

In the poſterior extremities there are in moſt of them two capitulæ, or heads, which are firmly joined to the vertebræ of the back, yet ſo as to form moveable articulations; for when they are drawn upwards, the cavity of the breaſt is enlarged for inſpiration, and ſo the contrary. The ribs of infants may be broken inwards like a green ſtick without the broken ends being ſeparated; which is often done, by the idle cuſtom of careleſs nurſes, taking hold of their breaſts, and hoiſting them up on one hand frequently: the ſhape of children's breaſts are many times quite ſpoiled by ſuch tricks, which occaſions weakneſs of body, crookedneſs, and other diſeaſes.

SECT III.

Of the CARTILAGES, LIGAMENTS, &c. of the THORAX.

Cartilages of the ſternum and ribs.

THE cartilages, ligaments, &c. of the vertebræ of the ſpine are already treated of, ſo far as to require no further comment here. The ſternum of an adult has commonly ſixteen cartilages (eight on each ſide) fourteen are articular, the other two ſymphyſes. Of the articular cartilages, two belong to the articulations of the clavicula, and twelve to thoſe of the true ribs, from the ſecond to the ſeventh incluſively. The two ſymphyſes are thoſe between the ſternum, and the firſt rib on each ſide. There is likewiſe another ſymphyſis by which the upper portion of the ſternum is connected to the lower, the cartilage of which is often obliterated in an advanced age. The apophyſis enſiformis is often bony towards the ſternum, and more or leſs cartilaginous at the other end. In very aged perſons it has been found entirely oſſified, and ſometimes wholly cartilaginous, even in adults. All the ribs have cartilaginous portions (as before mentioned) which differ from each other in length, breadth, incurvation, adheſions, and in their extremities are whiter, more poliſhed, broader and thicker in the natural ſtate than when they are dried. The cartilages of the baſtard, or falſe ribs, are naturally more ſlender and pliable than thoſe of the true ribs, the middle or inner ſubſtance of which acquires the conſiſtence of bones in old age, and their extremities ſometimes oſſify, and are immoveably fixed to the ſternum.

Ligaments of the ſternum and ribs.

The ſternum has ſeveral ligaments by which it is connected with the clavicles and ribs. It is joined to the clavicles by ſtrong ſhort ligaments fixed by one extremity round the edges of its ſuperior notches; by the other, in the extremity of each clavicle; and by the middle to the inter-articular cartilages already explained, ſurrounding the particular ligaments which go between the edges of theſe cartilages and the ſternum; and the capſular ligaments between them and the clavicles. All the ribs are connected to the bodies of the vertebræ, by ſtrong ſhort ligamentary faſciculi, fixed by one end round the foſſulæ in the vertebræ, and by the other round the head of each rib. The ribs are likewiſe tied to each other by thin liga-

ments

ments which go obliquely from the cartilage of each rib to that of the next.

The ten uppermoſt ribs on each ſide are connected to the tranſverſe apophyſes of the vertebræ of the back, by ſtrong ſhort articular ligaments fixed much in the ſame manner as thoſe between the heads of the ribs and bodies of the vertebræ. Both theſe articulations are provided with capſular ligaments.

The eleventh rib on each ſide, having no articulation with the tranſverſe apophyſes, is connected to them by auxiliary ſtrong ſhort ligaments fixed in its neck. The laſt rib is only joined by its head to the body of the twelfth vertebra of the back; but it is connected in a particular manner to the tranſverſe apophyſis of the firſt vertebra of the loins by a broad ligament. The firſt true rib has no ligamentary connexion with the ſternum, the cartilaginous ſymphyſis being ſufficient. The reſt are cloſely joined to that bone, in the ſame manner as the clavicles abovementioned. The cartilage of the firſt falſe rib is joined to that of the laſt true rib, by ſeveral ſhort ligamentary filaments; and the other baſtard ribs are connected together much in the ſame manner.

Mucilaginous glands.

The mucilaginous glands of all theſe articulations are very ſmall, but are accompanied by many fatty moleculæ lying round each joint.

The cartilages, ligaments, &c. of the aſper arteria, and other ſoft parts, are treated of along with the muſcles, to which the reader is referred.

SECT.

SECT. IV.

Of the MUSCLES of the Thorax.

Muſcles of the thorax.

AS the twelve vertebræ of the back make the poſterior part of the thorax, I ſhall firſt deſcribe the muſcles belonging thereto.

The longiſſimus dorſi, multifidus ſpinæ, ſemiſpinalis, ſacro-lumbalis, &c. are all that portion of fleſh betwixt the os ſacrum and the neck, which ſeeing there is no membrane to diſtinguiſh it into ſeveral muſcles, is all employed in the ſame actions, I ſhall give it the name of extenſor dorſi et lumborum, and deſcribe it all as one muſcle; tho' Albinus and others, divide it into ſeveral, which names may be ſeen in the Index of this work.

Extenſor dorſi et lumborum, vel multifidus ſpinæ.

Extenſor dorſi et lumborum, vel multifidus ſpinæ, ariſes from the upper part of the os ſacrum, the ſpine of the os ilium, the back parts of the lowermoſt vertebræ of the loins, and remarkably from thoſe ſtrong tendons which appear on their outſides. That part of this muſcle which is known by the name of ſacro-lumbalis is inſerted into all the ribs near their articulations with the tranſverſe proceſſes of the vertebræ, and into the tranſverſe proceſs of the laſt vertebra of the neck; beſides, as this paſſes over the ribs, it receives an origin from every rib, in a manner that cannot well be deſcribed. The portions of this muſcle which ariſe from the ribs, and are inſerted into other ribs above, will neceſſarily draw the back part of the ribs nearer together, which muſt always be

done

done as the back extends, and independent of other actions of the thorax. The next portion of this muſcle, called longiſſimus dorſi, is inſerted into all the tranſverſe proceſſes of the vertebræ of the back (belonging to the thorax) and partly into the ribs, and the uppermoſt tranſverſe proceſſes of the vertebræ of the loins; the upper end of it is neither very diſtinct from the complexus of the head, nor ſpinalis of the neck. The reſt of this muſcle, known by the names of ſemiſpinalis, ſacer, &c. ariſes alſo from all the tranſverſe and oblique proceſſes of the loins and back; every portion, except the lowermoſt, paſſing over five joints, is inſerted into the ſpinal proceſs of the ſixth vertebra above its origin, all the way up the back, and at the neck commences tranſverſalis colli. This paſſing of each portion of a muſcle over a few joints, diſtributes their force equally among all theſe joints, without the fibres being directed more obliquely than thoſe of penniformm or compound muſcles; but the neck and loins not having ſufficient proviſion of this ſort, there are ſmall muſcles between their proceſſes, which, tho' they are of little importance for the motions of thoſe parts, yet are ſufficient to diſtribute the force of larger muſcles equally among thoſe joints; and beſides the uſes of the extenſor dorſi et lumborum, which its name implies, it and its fellow alternately raiſe the hips in walking, which any one may feel by laying his hand upon his back.

Scalenus.

Scalenus ariſes from the tranſverſe proceſſes of the ſecond, third, fourth, fifth, and ſixth cervical vertebræ. It is inſerted in three parts, into the firſt, ſecond and ſometimes the third rib, being thus divided for the tranſmiſſion of the ſubclavian veſſels; hence ſome anatomical writers have made three muſcles of it, under the names of firſt, ſecond, and third ſcalenus, or prior, medius, and poſticus. This muſcle may bend the neck, but its chief uſe is to ſupport the upper ribs, and partly elevate the thorax.

Serratus ſuperior poſticus.

Serratus ſuperior poſticus lies immediately under the rhomboides, and ariſes from the ſpinal proceſſes of the two inferior vertebræ of the neck, and the three ſuperior of the thorax, but it is inſerted at the bending of the ſecond, third, and fourth ribs; this, with the ſcalenus, ſuſtains the upper ribs, that they might not be pulled downward by the depreſſors of the ribs in expiration, as the lower ribs are upward in inſpiration.

Serratus inferior poſticus.

Serratus inferior poſticus ariſes from the ſpinal proceſſes of the three ſuperior vertebræ of the loins, and two inferior of the thorax, and is inſerted at the bending of the ninth, tenth, and eleventh ribs; it pulls down the ribs in expiration.

Intercoſtales externi et interni.

Intercoſtales externi et interni, are eleven pair on each ſide, in the interſtices of the ribs; from their ſituations diſtinguiſhed into external and internal; they all ariſe from the under edge of each rib, and are inſerted into the upper edge of the rib below. The external are largeſt backward, having their firſt beginnings from the tranſverſe proceſſes of the vertebræ like diſtinct muſcles, which ſome call levatores coſtarum. The internal run all from above obliquely backward, being thickeſt forward, and thinneſt toward the ſpine; theſe are alſo continued betwixt the cartilages of the ſternum, with fibres perpendicular to the cartilages; and between the cartilages of the loweſt ribs, they are inſeparable from the obliquus aſcendens abdominis.

Theſe muſcles, by drawing the ribs nearer to each other, pull them all upward, and dilate the thorax, they being ſuſtained at the top by the ſcalenus and ſerratus ſuperior poſticus. To theſe Mr. Cowper adds ſome fleſhy fibres, which run from one rib over a ſecond to a third, near the ſpine which are levatores coſtarum.

Triangularis ſterni.

Triangularis ſterni ariſes from the lower and interior part of the ſternum, and internally from the cartilago enſiformis; it is inſerted on each ſide into the cartilages of the fourth, fifth, ſixth and ſeventh true ribs; and it is one of the conſtrictor or depreſſor muſcles of the breaſt, which pulls the ribs to the bone of the ſternum, and thereby bends its cartilages in exſpiration.

Diaphragma.

Diaphragma is the tranſverſe muſcle which ſeparates the thorax from the abdomen. This is a very broad and thin muſcle, ſituated at the baſis of the thorax, and ſerving as a tranſverſe partition to ſeparate that cavity from the abdomen: for this reaſon, the Greeks termed it diaphragma, and the Latins, ſeptum tranſverſum. It forms an oblique inclined arch, the fore-part of which is higheſt, and the poſterior part loweſt, making a very acute angle with the back; its upper ſuperficies is convex and its lower concave. It is connected with the ſternum, the ſpurious ribs, the pericardium, the mediaſtinum, and the vertebræ of the loins. There are in the diaphragm two large foramina; the firſt is in the left ſide of it, and gives paſſage to the gula, and the par vagum; the ſecond is in the right ſide, and the lower trunk of the vena cava paſſes through it: there is alſo an interſtice between the two heads of the lower part, through which paſs the aorta, the vena azygos, and the ductus thoracicus.

The diaphragm is covered with a membrane on the upper part from the pleura; on the lower from the peritonæum. This muſcle ariſes on the right ſide by a proceſs from three lumbal vertebræ, and one of the thorax; and on the left, from one ſuperior of the loins, and inferior of the thorax; and is inſerted into the lower part of the ſternum, and the five inferior ribs. The middle of this muſcle is a flat tendon, from whence the fleſhy fibres begin and are diſtributed, like radii from a centre to a circumference. The uſes of the diaphragm are, firſt, to aſſiſt in reſpiration; for in taking in the breath, it is preſſed downwards; and in expiration, it riſes upward, into the cavity of the thorax: ſecondly, to aſſiſt the neceſſary motions of the contents of the abdomen, viz. of the ſtomach, inteſtines, liver, and ſpleen; and in the promoting the ſecretions of the chyle, bile, &c. and laſtly, for aſſiſting the expulſion of the fæces, the urine, the fœtus in parturition, and of the ſecundines. When the diaphragm acts alone, it conſtricts the thorax, pulling the ribs downward, and approaches toward a plane; which action is generally performed to promote the ejection of the fæces. In large inſpirations, when the intercoſtals lift up the ribs to widen the thorax, this muſcle acts enough to bring itſelf toward a plane without overcoming the force of the intercoſtals, by which means the breaſt is at once widened and lengthened: when it acts with the abdominal muſcles, it draws the ribs nearer together, and conſtricts the thorax; while the ſuperior force of the abdominal muſcles thruſting the parts of the lower belly againſt it, it becomes at the ſame time convex upward, and ſhortens the thorax, which occaſions the largeſt expirations; or acting alternately with the abdominal muſcles only, a more moderate inſpiration, and exſpiration is made by ſhortening and lengthening the thorax only, which is what we chiefly do when lying down; or acting alternately with the intercoſtals only, a moderate exſpiration and inſpiration is cauſed by the widening and narrowing the breaſt, which is what we are moſt prone to in an erect poſition, the muſcles of the abdomen at ſuch times being employed in ſupporting the parts contained in the abdomen. Though theſe motions of the ribs require at any one time but very little force, the air within the thorax balancing that without, yet that theſe muſcles, whoſe motions are eſſential to life, may be never weary, the inſpirators in moſt men, have force ſufficient to raiſe mercury in a tube twenty-four or twenty-five inches in an erect poſture; and the exſpirators ſix or ſeven; the firſt of which will require about four thouſand pound force in moſt men, and the other proportional. But I imagine, that on lying down, theſe proportions will differ by the weight of the parts contained in the abdomen.

In all bodies I have diſſected, (ſays Cheſelden) I have found the diaphragm convex upward, which gave me occaſion to think, that all animals died in exſpiration, till the foremenmentioned experiment diſcovered, that the muſcles of inſpiration were ſtronger than thoſe of exſpiration; which led me to make the following experiment. I cut the windpipe of a dog, and having a ſtring ready fixed, I put a cork into it, and tied it faſt inſtantly after inſpiration; upon which I obſerved, that the diaphragm, and the other muſcles of inſpiration and exſpiration, were alternately contracted and diſtended for ſome time; but when he was dead, the abdominal muſcles were in a ſtate of contraction, the ribs were elevated to dilate the thorax, and the diaphragm was convex upward. This experiment alſo ſhews, that the diaphragm is not a muſcle of equal force either with the depreſſors or elevators of the ribs, it neither hindering the elevators from raiſing the breaſt, nor the depreſſors from thruſting it upward, by compreſſing the parts contained in the abdomen, though the breaſt was full of air.

For the above obſervations and experiments, I am obliged to that ingenious anatomiſt Mr. Cheſelden. For the other muſcles, fixed to the ſuperior part of the trunk, (not here mentioned) See Chap. VI. Sect. 4. where they properly belong, and are deſcribed; their actions tending chiefly to the upper extremities and not to the thorax. The mammæ, or breaſts, being moſtly glandular, will be ſpoken off under that head, in Sect. 6. of this chapter.

The aſpera arteria and œſophagus, or trachea and gullet, (as they are contained within the cavity of the thorax) will be deſcribed in the next Section, with the viſcera, to which the reader is referred.

SECT. V.

Of the VISCERA, &c. of the THORAX.

Viſcera of the thorax, &c.

THOUGH the heart and lungs are the only proper viſcera of the thorax, yet I ſhall now deſcribe all the internal parts of that cavity, except the thoracic duct, blood-veſſels, nerves, and glands, which are referred to their proper place. The parts here mentioned are the pleura, mediaſtinum, lungs, heart, pericardium, a portion of the trachea arteria, and the greater part of the œſophagus.

Pleura.

The pleura is a fine, ſmooth, robuſt, and tenſe membrane, adhering very cloſely to the inner ſurface of the ribs, ſternum, and intercoſtal muſcles, and lining the whole cavity of the thorax, except the diaphragm, which is covered with no other than its own proper membrane. Its ſtructure reſembles two ſacks or bags (one on each ſide the thorax) which contains the two lobes of the lungs: from the conjunction of theſe two ſacculi of the pleura, in the middle of the thorax, is formed the mediaſtinum, which ſee below.

The pleura is compoſed of a double membrane of a very firm texture, and plentifully ſtored with blood-veſſels and nerves, in all which it reſembles the peritonæum (deſcribed in the next chapter) and likewiſe, in that it is made up of an inner true membranous lamina, and a cellular ſubſtance on the outſide, which is a production or continuation of the lamina.

Its veſſels are arteries, veins, nerves and lymphatics. The arteries ariſe from the intercoſtals, the diaphragmatic, and the mammary ones, and are very numerous; the veins from the veins of the ſame name with thoſe arteries; but all of them diſcharge themſelves into the trunk of the vena azygos, and the upper trunk of the cava. The nerves are from the vertebræ of the thorax, and the diaphragmatic ones. The lymphatics all run to the ductus thoracicus. The uſe of the pleura is to make the inſide of the thorax ſmooth and equal, and to lubricate and ſtrengthen the whole cavity.

Mediaſtinum. Mediaſtinum is a double membrane continuous to the ſternum, ſituated under it, and adhering firmly to it; it is formed by the continuation of the pleura, which comes from the ſternum, and goes through the middle of the thorax to the vertebræ, dividing the cavity of the thorax longitudinally into two parts; but as it is not exactly under the middle of the ſternum, but ſomewhat to the left ſide, the right part of the thorax is larger than the left: hence may be judged the uncertainty of trepanning the ſternum, recommended by the ancients in ſome caſes.

This double ſeptum, or partition, contains, in its duplicature, the heart in its pericardium, the vena cava, the œſophagus, and ſtomachic nerves.

The mediaſtinum receives veins and arteries from the mammary and diaphragmatic veſſels, and ſometimes has proper and particular ones of its own from the aorta and cava: theſe are then called the mediaſtinal veſſels. Its nerves, which are ſmall, are from the diaphragmatics, and the par vagum. It has a number of lymphatics, which run to the ductus thoracicus. The uſes of the mediaſtinum are two: the firſt is to divide the breaſt longitudinally into two parts, by which ſeveral great purpoſes are anſwered; as, 1. that on one of the lobes of the lungs being ulcerated, the other might not be immediately affected. 2. That water, matter, or any thing elſe contained in one part of the thorax, might not, at the ſame time, affect both parts of the lungs. 3. That in caſe of a wound in one ſide of the thorax, reſpiration might be continued in the other, and the perſon not be immediately ſuffocated. The ſecond general uſe of the mediaſtinum is to ſupport the heart in its pendulous ſtate, for the benefit of its free motion, eſpecially when we lie on our backs.

Lungs.

The lungs are the largeſt viſcus of the thorax: they are ſituated in the two ſides of it, with the heart as it were between them; and are connected by means of the mediaſtinum, with the ſternum and vertebræ; with the heart, by means of the pulmonary veſſels, and immediately with the aſpera arteria. The colour of the lungs in infants is a fine florid red; in adults, it is darker; and in old people, livid, or variegated with black and white. When inflated, they have ſome reſemblance to the hoof of an ox; and are convex on the upper ſide next the ribs, and concave underneath next the diaphragm. They are divided into two large lobes, one ſeated on each ſide of the mediaſtinum; the left lobe, which is the ſmaller, is ſubdivided into two lobules; and the right, which is larger, is ſubdivided into three lobules. The double membrane with which the lungs are ſurrounded, is continuous externally with the plcura, and internally not only immediately covering the ſubſtance of the lungs but alſo its inner lamina, and fills up the interſtices which are between the bunches of the ſmall lobes or lobules with little veſicular cells. The fine capillary blood-veſſels are ſo thick upon this membrane, that it ſeems to be nothing but a net-work of veins and arteries. The ſubſtance of the lungs is ſpongeous, or veſiculous, and they ſeem, indeed, entirely compoſed of an infinite number of little lobes, or lobules, of various figures and magnitudes; but their ſurfaces are ſo adapted to one another, as to leave but very few and ſmall interſtices.

Theſe lobes are diſpoſed like ſo many bunches of grapes, upon the ſides of the bronchia, or ramifications of the trachea (which ſee below); each little lobe, or lobule, contains within its own proper membrane, an infinite number of ſmall orbicular veſſels, which leave ſmall interſtices between them, full of little membranes, like thoſe which tye the lobes together. The bronchia, in their origin, are formed of imperfect annuli, and in their progreſs of cartilaginous and membranous ſegments, very curiouſly connected and joined together; theſe have their origin from the trachea; and after being ſubdivided into innumerable ramifications, finally terminate in thoſe ſmall veſicles which form the greater part of the ſubſtance of the lungs, as abovementioned; theſe extremities (of the branches of the bronchia) open into the cavity of the veſſels, which are properly formed by its membranes; but the capillary blood-veſſels are only ſpread upon the veſicles like a net, a net, with frequent and large inoſculations. The veſſels which enter the lungs are the trachea, or aſpera arteria, by which we draw in the air, (deſcribed below) the arteria pulmonalis, which comes from the right ventricle; See Chap. I. Sect. 5 and the vena pulmonalis, whoſe trunk opens into the left ventricle of the heart; ſee Chap. I. Sect. 6. each of theſe divides into two branches, for the two great lobes of the lungs, where they are ſubdivided into as many branches as there are little lobes or veſicles in the lungs. Where-ever there is a branch of the trachea, there is alſo a branch of the vein and artery; and the trachea is always in the middle. Upon the branches of the trachea arteria, (which, as I obſerved before, are termed bronchia) runs a ſmall artery called arteria bronchialis, and a ſmall vein called vena pneumonica; the artery comes from the aorta, and the veins open into the ſubclavian. Upon the bronchi, even to their minuteſt ramifications, run, likewiſe, the fine threads of the eighth pair of nerves. Beſides theſe, the lungs have lymphatics, which diſcharge themſelves into the thoracic duct; but they are ſmaller, and make more frequent inoſculations than are obſerved any where elſe. The known uſes of the air's entering the lungs, are to be inſtrumental in ſpeech, and to convey effluvia into the noſe, as it paſſes, for the ſenſe of ſmelling; but the great uſe of it (ſays Cheſelden) by which life is preſerved, I think we do not underſtand.

By ſome the force of the air is thought to ſeparate the globuli of the blood, that have cohered in the ſlow circulation through the veins; and this opinion ſeems to be favoured by the many inſtances of the polypuſes, which are large concretions of the globuli of the blood, found in the veins near the heart, and in the right auricle and ventricle of the heart; and their being ſo ſeldom found in the pulmonary veins, or in the left auricle or ventricle of the heart, or in any of the arteries; but if it is true that, while the blood paſſes through the lungs, many cohering globuli are ſeparated, it ſtill remains to be proved that theſe ſeparations are made by the force of the air. Dr. Keil has computed the force of the air in the ſtrongeſt exſpirations againſt the ſides of all the veſicles, to be equal to fifty thouſand pound weight. Mr. Cheſelden ſays, he thinks the moſt probable argument for the air's entering into the blood by the lungs, or rather ſome particular part of the air may be fetched from a known experiment of each man in a diving bell wanting near a gallon of freſh air in a minute; and if preſſure only was wanted in this caſe, they often deſcend, till the preſſure of the air is three or four times what it is upon the ſurface of the earth, without any advantage from that preſſure; and animals dying ſo ſoon in air that has been burnt, and their being ſo eaſily intoxicated by breathing air much impregnated with ſpirituous liquors, are alſo arguments of a paſſage this way into the blood. Beſides, if the preſſure of the air, in the cells of the lungs is the only uſe of it, I do not ſee but enough of that may be had while a man is hanging, if the muſcles of the thorax do but act upon the air which was left in the thorax, when the rope was firſt fixed; and yet death is brought about by hanging no other way than by interrupting of the breath, as I have found by certain experiments. Dr. Drake has endeavoured to ſhew, that the uſe of reſpiration is to aſſiſt the ſyſtole of the heart; but this uſe requires, that the ſyſtole and diaſtole of the heart ſhould keep time with expiration and inſpiration, which is contrary to experience.

The lungs of animals before they have been dilated with air, are ſpecifically heavier than water, but upon inflation they become ſpecifical lighter, and ſwim in water; which experiment may be made to diſcover whether a dead child was ſtill-born, or not; but if the child has breathed but a little, and the experiment is made long after, the lungs may be collapſed and grow heavier than water, as I have found by experiment, which may ſometimes lead a man to give a wrong judgment in a court of judicature, but then it will be on the charitable ſide of the queſtion. Adheſions of the lungs to the pleura are in men ſo common, I know not how to call it a diſeaſe; they being found ſo, more or leſs, in moſt adult perſons, and without any inconvenience, if the lungs are not rotten.

Pericardium.

The pericardium, or heart-purſe, is an exceeding ſtrong membranaceous bag, looſely including the heart; the figure of the pericardium is conic, like that of the heart itſelf; its ſize is ſuch as can conveniently contain the heart without preſſing upon it; it is connected with the mediaſtinum, with a great part of the diaphragm, and with the large veſſels of the heart, which, together with this covering, ſuſtains alſo the heart itſelf in its place. The pericardium is compoſed of a double membrane; the exterior one is common with the pleura and mediaſtinum; the interior is proper, lubricous, and is continuous with the coats of the larger veſſels. This membrane, when expanded upon the finger, frequently diſcovers a great number of foraminula, or little apertures. The arteries and veins of the pericardium are from thoſe of the mediaſtinum and diaphragm, and its nerves are alſo from the diaphragmatics. Its lymphatics all run to the thoracic duct. The uſes of the pericardium are, to ſupport the heart in a pendulous ſtate, eſpecially when we lie down; to defend the heart from the cold air taken in at the lungs; to preſerve it from being injured by water, by matter, or any other extraneous fluid in the cavity of the thorax; and to contain a liquor to lubricate the ſurface of the heart, facilitate its motions, and abate its friction againſt the pericardium.

The liquor of the pericardium is a fluid reſembling in appearance water in which raw fleſh has been waſhed. Anatomical writers in general deduce this fluid from certain glands ſituated either in the pericardium, or in the heart itſelf; but as theſe glands are not to be found, Heiſter thinks it more rational to ſuppoſe that it is expreſſed out of the auricles of the heart in its ſyſtole. The pericardium is found ſometimes, in perſons who have been long hectic, to cohere with the ſubſtance of the heart; and there have been inſtances of its having been wholly wanting.

The heart is a muſcular body included in the pericardium (above deſcribed) and ſituated in the cavity of the thorax, nearly in the middle of the breaſt, on the anterior part Heart,

Its auricles.

of the diaphragm, between the lobes of the lungs and the two laminæ of the mediaſtinum. The heart is the primary organ of the circulation of the blood, and conſequently of life. It is, in ſome meaſure, of a conical figure, flatted on the ſides, round at the top or apex, and oval at the baſis; its lower part is plane, and the upper part convex. Its ſituation is nearly tranſverſe, or horizontal; ſo that its baſe is in the right ſide, upon the fourth and fifth vertebræ of the thorax; and its apex or point is inclined downward, lying with the greateſt part of its bulk in the left ſide of the thorax; and conſequently it is there that the pulſation is felt. Its baſe is fixed by the veſſels going to and from it; but its apex is free, and is received in a kind of cavity of the left lobe of the lungs, as may be obſerved, the lungs being extended with air. This incumbrance on the left lobe of the lungs ſeems to be the cauſe of that ſide's being moſt ſubject to pleuritic pains, which have generally been found upon diſſection to proceed from inflammations in the lungs. The length of the human heart is about ſix fingers breadth: its breadth at the baſe is about five fingers; and its circumference about thirteen. At the baſis of the heart, on each ſide, are ſituated two appendices called auricles to receive the blood; the right from the two venæ cavæ, and the left from the pulmonary veins. See Chap. i. Sect. 6. Of the Veins in general. In the right auricle, at the meeting of the cavæ, is an eminence called tuberculum Loweri, which directs the blood into the auricle; immediately below this tubercle, in the ending of the cava aſcendens, is the veſtige of the foramen ovale, and near this, in the auricle, is the mouth of the coronary veins. Both auricles are ſtrengthened by muſcular columnæ, like the ventricles. The left is much leſs than the right, but the difference is ſupplied by a large muſcular cavity, which the veins from the lungs afford in that place. The ſides of this muſcular cavity are thicker than the ſides of the right auricle, in about that proportion in which the left ventricle of the heart is ſtronger than the right; their uſes being to receive blood from the veins that lead to the heart, and preſs it into the ventricles, a ſtrength in each auricle proportionable to the ſtrength of the ventricle that it is to fill with blood, ſeems neceſſary: and this different thickneſs of the coats of the auricles makes the blood in the left, which is thickeſt, appear through it of a paler red; but when it is let out of the auricles, it appears alike from both; which they would do well to examine, who affirm the blood returns from the lungs of a more florid colour than it went in; and offer it as an argument of the blood's being mixed with air in the lungs.

Its ventricles.

There are alſo two cavities in the heart, called its ventricles, which receive the blood, and are hollow muſcles, or two cavities in one muſcle, whoſe fibres interſect one another, ſo as to make the preſſure of the heart upon the blood more equal and effectual, and are alſo leſs liable to be ſeparated than they would have been, if they had lain in one direction. Both theſe cavities receiving the ſame quantities of blood in the ſame times, and always acting together, muſt be equal in ſize, as it is generally ſuppoſed they equally difdiſcharge what they contain at every ſyſtole; nevertheleſs, the left appears leſs than the right, it being found empty in dead bodies, and the right uſually full of blood. Each ventricle opens at the baſe by two orifices, one of which anſwers to the auricles, the other to the mouth of a large artery; the former receives the blood through the veins, the latter delivers the blood through the arteries. The right ventricle is ſituate anteriorly, and is thinner and weaker in its circumference, but uſually much more capacious than the left: it receives the blood from the vena cava and the right auricle, and delivers it into the pulmonary artery, to be carried to the lungs. The left ventricle is much ſtronger and thicker in its ſides, but is narrower and ſmaller than the right; it receives the blood from the pulmonary vein and the left auricle, and drives it very forcibly into the aorta, and ſo through the whole body.

Its valves. Over the orifices of the veins, at the entrance of the auricles in each ventricle, are placed valves, to hinder a return of blood while the heart contracts; thoſe in the right ventricle are named tricuſpides, thoſe in the left mitrales: in the beginning of each artery from the heart, are placed three valves, which hinder a return of blood into the ventricles. The firſt ſort of valves open inward toward the ventricles, allowing the blood to enter the heart, but hindering it from returning the ſame way; the other kind open outward from the heart toward the great veſſels, ſuffering the blood to go out of the heart, but hindering it from returning. Theſe laſt are termed ſemilunar valves, but thoſe in the pulmonary artery are more properly named ſigmoidales, and thoſe in the aorta ſemilunares.

The inner ſurface of the ventricles is very uneven, many eminencies and cavities being obſervable therein; the ventricles are divided by a ſeptum running between the edges; and their moſt conſiderable eminencies are thick fleſhy productions called columnæ. To the extremities of theſe pillars are faſtened ſeveral tendinous cords, the other ends of which are joined to the valvulæ tricuſpides There are likewiſe other ſmall, ſhort, tendinous ropes along both the edges of the ſeptum, between the ventricles; theſe ſmall cords lie in an oblique tranſverſe ſituation, and form a kind of net-work at different diſtances from one ſide of the ventricles to the other: theſe ſerve partly to aſſiſt the contraction of the heart in its ſyſtole, and partly to prevent its too great dilation in its diaſtole. See the ſection on the Circulation of the Blood.

The cavities of the inner ſurface of the ventricles are ſmall deep foſſulæ or lacunæ, placed very near each other, with ſmall prominent interſtices between them. The greateſt part of theſe lacunæ are orifices of the venous ducts.

Its blood-veſſels and nerves.

The blood-veſſels of the heart are of two kinds, common and proper; its proper or peculiar veſſels being the coronary arteries and veins. The common veſſels of the heart are two veins, called the vena cava and the vena pulmonalis; and two arteries, the pulmonary one, and aorta. The nerves of the heart are ſmall, and ariſe from the par vagum and intercoſtals. See Chap. i. Sect. 5, 6, and

7, Of the Arteries, Veins, and Nerves in general.

Arteriæ coronariæ cordis.

The coronary arteries, which are two in number, go out from the beginning of the aorta, and afterwards ſpread themſelves round the baſis of the heart, to the ſubſtance of which they ſend numerous ramifications. One turns to the right hand, the other to the left: the right coronary artery runs in between the baſis and right auricle all the way to the flat ſide of the heart, and ſo goes half way round. The left artery has a like courſe between the baſis and left auricle, and before it turns on the baſis, it ſends off a capital branch, which runs between the two ventricles. Another principal branch goes off from the union of the two arteries on the flat ſide of the heart, which running to the apex, there joins the other branch.

Venæ coronariæ cordis.

The coronary veins are diſtributed exteriorly much in the ſame manner as the arteries, but they end partly in the right auricle, and partly in the right ventricle; their trunk principally in the former, by a particular orifice, furniſhed with a ſemilunar valve. They likewiſe terminate in the left ventricle, but in ſmaller numbers; and in both they end by certain venal ducts, which open into the foſſulæ or lacunæ already taken notice of, in the uneven inner ſides of the ventricles. All the coronary veins and their ramifications communicate with each other.

Trachea, or wind-pipe.

The trachea, or aſpera arteria, vulgarly called the wind-pipe, is a large canal, partly cartilaginous, aud partly membranous, extended from the mouth to the lungs. It is ſituated in the middle and anterior part of the neck, and is connected with the fauces, lungs, and œſophagus. Anatomiſts commonly divide it into two parts; the larynx, which is only its mouth, or entrance, and the aſpera arteria, properly ſo called. The aſpera arteria extends from the larynx to the bronchia, or lungs, being in ſome meaſure of a conic figure. Its beginning is cylindrical, and capable of admitting a finger; and its other end is ſomewhat narrower. It runs down into the thorax, under the ſternum, between the two pleuræ, through the upper ſpace left between the duplicature of the mediaſtinum, behind the thymus gland. Having reached as low as the fourth vertebra of the back, and curvature of the aorta, it divides into two lateral parts or branches, one towards the right hand, the other towards the left, which enter the lungs, and are diſtributed through them in the manner there deſcribed. Theſe two branches are called bronchia, and that on the right ſide is ſhorter than that on the left; whereas the right pulmonary artery is the longeſt. The trachea is made up of ſegments of circles, or cartilaginous rings, diſpoſed in ſuch a manner as to form a canal open on the back-part; the cartilages not going quite round; but this opening is filled by a ſoft glandular membrane, which completes the circumference of the canal. Theſe circles, or hoops, are in number from ſixteen to twenty, and are all connected by a very ſtrong, elaſtic, membranous ligament, fixed to their edges.

The canal of the aſpera arteria is lined on on the inſide by a particular membrane, which appears to be partly fleſhy, or muſcular, and partly ligamentary, perforated by an infinite number of ſmall holes, more or leſs imperceptible,

ceptible, through which a mucilaginous fluid continually paſſes, to defend the inner ſurface of the trachea againſt the acrimony of the air which we breathe.

At the angle of the firſt ramification of the trachea arteria, we find, on both the fore and back ſides, certain ſoft, roundiſh, glandular bodies, of a livid colour, and of a texture partly like that of the thymus, and partly like that of the glandulæ thyroides. There are other glands of the ſame kind, at the origin of each ramification of the bronchia, but they decreaſe proportionably, in number and ſize: they are fixed immediately to the bronchia, and covered by the interlobular ſubſtance; and they ſeem to communicate by ſmall openings, with the cavity of the bronchia, as before obſerved.

The uſes of the trachea are to aſſiſt in deglutition, and to be aſſiſtant to the lungs. On the exterior part of the trachea are the thyroide and bronchial glands, (deſcribed in the next ſection) which ſecrete a humour to moiſten it: its arteries are from the external carotids, the veins from the jugulars, and the nerves from the recurrent ones of the plexus cervicalis. See the next ſection.

Oeſophagus, or gullet.

The œſophagus or gullet is that membranous canal which conveys the aliment from the mouth to the ſtomach. It is partly muſcular, and partly membranous, ſituated behind the trachea arteria, and before the vertebræ of the back, from near the middle of the neck, down to the lower part of the thorax; from whence it paſſes into the abdomen, through a particular hole of the ſmall, or inferior muſcle of the diaphragm, and ends at the upper orifice of the ſtomach. Its upper part is wide and open, ſpread behind the tongue to receive the maſticated aliment, and is termed pharynx, the muſcles of which are already ſpoken of. The ſubſtance of the œſophagus is compoſed of ſeveral coats, almoſt in the ſame manner as the ſtomach, of which it is the continuation. The firſt coat, while in the thorax, is formed only by a duplicature of the poſterior part of the mediaſtinum, and is wanting above the thorax, and in the neck, where the outer coat of the œſophagus is only a continuation of the cellular ſubſtance belonging to the neighbouring parts. The ſecond coat is muſcular, made up of ſeveral ſtrata of fleſhy fibres. The outermoſt are chiefly longitudinal, but are not all continued from one end of the canal to the other. The following ſtrata are obliquely tranſverſe; the next to theſe more tranſverſe; and the innermoſt are turned a little obliquely the contrary way. They croſs each other irregularly in many places, but are neither ſpiral nor annular. The third coat is termed the nervous coat, and is like that of the ſtomach and inteſtines. It is differently folded, or plaited, according to its length; being much wider than the muſcular coat, and ſurrounded by a whitiſh, fine, filamentary ſubſtance, like a kind of cotton, which, when ſteeped in water, ſwells and grows thicker.

The fourth or innermoſt coat reſembles, in ſome meaſure, that of the inteſtines, except that, inſtead of the villi, it has ſmall and very ſhort papillæ. It is folded lengthwiſe, like the third coat, ſo that the œſophagus when cut acroſs, repreſents one tube within an-

another. Through the pores of this coat, a viſcid lymph is continually diſcharged.

The œſophagus, from its very beginning, turns a little to the left hand, and naturally runs along the left extremities of the cartilages of the aſpera arteria: The arteries of the œſophagus are from the carotids, the aorta, the intercoſtal, and the cœliac. The veins are from the jugulars, the azygos, and the coronary veins of the ſtomach; and the nerves from the par vagum. There are alſo certain excretory ducts, called ductus excretorii novæ Vercelloni, which ariſe from the glands, and convey a ſaltiſh liquor into the œſophagus and ſtomach; (ſee the next ſection). The glands, from which theſe ducts have their origin, are of three kinds, viz. the gaſtric glands, which are conglomerate, and are ſituated near the left orifice of the ſtomach; the dorſal ones, which are ſituated near the fifth vertebra of the thorax; and the bronchical, thyroide, and tracheal, deſcribed below. The uſe of the œſophagus is to carry the meat from the mouth into the ſtomach, by means of the muſcles of the pharynx and fleſhy fibres of the gula, which perform its periſtaltic motion and alſo for a commixtion of the liquid ſerving for digeſtion.

SECT. VI.

Of the ARTERIES, VEINS, NERVES, and GLANDS of the THORAX.

Arteries of the thorax.

THE arteries of the thorax are various, and proceed chiefly from the aorta already ſpoken of. Its branches take their names from the parts they are beſtowed on; the principal branches are, arteriæ coronariæ cordis, carotides, ſubclaviæ (from the latter ariſe the mammaria interna, mediaſtina, pericardia, diaphragmaticæ, thymica and trachealis,) theſe from the aorta aſcendens; from the ſuperior portion of the aorta deſcendens ariſe arteriæ bronchiales, œſophageæ, intercoſtales, to their parts of the thorax. The carotids, and coronary arteries of the heart are already ſpoken of. See the laſt ſection.

Arteria ſubclavia.

The ſubclavian arteries are ſo named from their ſituation near the clavicles, in the tranſverſe direction of which they run; they are two in number, one right the other left. Theſe arteries ariſe from the arch of the aorta, on each ſide of the left carotid, which commonly lies in the middle between them; but when both carotids go out ſeparately, they both lie between the ſubclaviæ. Theſe arteries terminate, or rather change their name, above the middle of the two firſt ribs, between the anterior inſertions of the muſculi ſcaleni. The left is ſhorter than the right, and runs more obliquely, but their diſtributions are much the ſame, therefore one deſcription will ſuffice for both. They firſt give off ſmall arteries to the mediaſtinum, thymus, pericardium, and aſpera arteria; but ſometimes theſe are branches of the mammaria interna, eſpecially the mediaſtina. Afterwards they ſend off the mammaria interna, cervicalis and vertebralis, and ſometimes an intercoſtal artery which goes to the firſt ribs, called intercoſtalis ſuperior. The right ſubclavian, at about a finger's breadth from its origin, alſo often produces the common carotid of the ſame ſide.

Arteria thymica.

The arteria thymica communicates with the mammaria interna, and ariſes from the ſubclavian. The thymus receives likewiſe ſome branches from the mammaria interna, and intercoſtalis ſuperior. The ſame obſervation may be applied to the mediaſtina and pericardia.

Arteria pericardia.

The pericardia ariſes much in the ſame manner with the thymica, (viz. ſometimes from the anterior middle part of the common trunk of the ſubclavian and carotid) and runs down upon the pericardium all the way to the diaphragm, to which it ſends ſome ſmall ramifications.

Arteria mediaſtina.

The mediaſtina ariſes ſometimes immediately after the thymica, and is diſtributed principally to the mediaſtinum.

Arteria trachealis.

The trachealis runs up from the ſubclavia, in a winding courſe, along the aſpera arteria, to the glandulæ thyroideæ and larynx, detaching ſmall arteries to both ſides, one of which runs to the upper part of the ſcapula.

Arteria mammaria interna.

The internal mammary artery comes from the anterior and lower ſide of the ſubclavia, near the middle of the clavicula, and runs down for about one finger's breadth, behind the cartilages of the true ribs, an inch diſtant from the ſternum. In its paſſage, it ſends branches to the thymus, mediaſtinum, pericardium, pleura, and intercoſtal muſcles; and through theſe muſcles, and between the cartilages of the ribs, to the pectoralis major, mammæ, membrana adipoſa, and ſkin. Several of theſe branches communicate by anaſtomoſes with the mammaria interna, and other arteries of the thorax, eſpecially in the ſubſtance of the pectoralis major, and likewiſe with the intercoſtals. Afterwards it goes out of the thorax, on one ſide of the appendix enſiformis, and is loſt in the muſculus abdominis rectus, a little below its upper part; communicating at this place with the arteria epigaſtrica; and in its courſe it gives branches to the peritonæum, and the anterior parts of the oblique and tranſverſe muſcles of the abdomen.

Arteria intercoſtalis ſuperior. When the ſuperior intercoſtal artery does not go out from the trunk of the aorta deſcendens, it commonly ariſes from the lower ſide of the ſubclavian, and runs down on the inſide of the two, three, or four uppermoſt true ribs, near their heads, ſending off under each rib a branch, which runs along the lower edge, and ſupplies the intercoſtal muſcles, and neighbouring parts of the pleura. Theſe branches all communicate with one another, up and down the intercoſtal muſcles. They alſo pierce theſe muſcles, and give branches to the muſculi ſterno-hyoidæi, ſubclavius, vertebrales, and bodies of the vertebræ, pectoralis, and through the notches of the firſt four vertebræ to the medulla ſpinalis and its coverings.

Arteria bronchialis. The bronchial arteries go either from the foreſide of the ſuperior part of the deſcending aorta, firſt intercoſtal, or arteriæ œſophageæ. They riſe ſometimes ſingle, ſometimes double, ſometimes triple, and adhere every where firmly to the bronchia; their branches, or ramifications, communicate ſometimes with thoſe of the pulmonary vein, arteria œſophagea, coronaria cordis, and vena azygos.

The

Arteriæ œſophageæ.

The œſophageæ are generally two or three in number, though ſometimes but one. They ariſe anteriorly from the aorta deſcendens, and are diſtributed to the œſophagus, &c. Sometimes the uppermoſt œſophagus produce a bronchial artery.

Arteriæ intercoſtales inferiores.

The inferior intercoſtals are commonly ſeven or eight on each ſide, and ſometimes ten, when the ſuperior intercoſtals ariſe likewiſe from the aorta deſcendens; in which caſe, theſe run obliquely up upon the ribs. They ariſe along the back ſide of the deſcending aorta generally in pairs, all the way to the diaphragm, and run tranſverſely toward each ſide, on the bodies of the vertebræ. Thoſe on the right ſide paſs behind the vena azygos; and afterwards they all run to the intercoſtal muſcles, along the lower edge of the ribs, all the way to the ſternum or near it. They ſend branches to the pleura, vertebral muſcles, muſcles of the thorax, and to the upper portions of the muſcles of the abdomen; and they communicate with the arteriæ epigaſtricæ and lumbares. Before they take this courſe along the ribs, &c. each detaches a branch to the great canal of the ſpina dorſi, which theſe divide in two; one running tranſverſely on the anterior ſide of the canal, the other on the poſterior ſide. Both communicating with the like arteries from the other ſide of the ſpine, form a kind of arterial rings as do the arteriæ lumbares. After the above courſe, each intercoſtal about the middle of the rib ſends a principal branch internally and another externally; thoſe that run upon the falſe ribs, are afterwards diſtributed to the abdominal and other neighbouring muſcles, particularly to thoſe of the diaphragm, almoſt in the ſame manner with the arteriæ phrenicæ. They alſo communicate with the lumbares, and ſometimes with branches of the hypogaſtricæ.

Arteria thoracica ſuperior vel mammaria externa.

The ſuperior thoracica or external mammary artery, runs down in a winding courſe on the lateral parts of the thorax, and croſſes the ribs. It gives branches to the two pectoral muſcles, to the mamma, muſculus ſubclavius, ſerratus major, latiſſimus dorſi, and to the upper-portions of the coraco-brachialis and biceps.

Arteria thoracica inferior.

The inferior thoracic artery runs along the inferior coſta of the ſcapula, to the muſculus ſubcapularis, teres major and minor, infra ſpinatus ſerratus major, latiſſimus dorſi, and the neighbouring intercoſtal muſcles, communicating with the arteriæ ſcapulares.

Veins of the thorax.

In deſcribing the veins, I ſhall begin with the great trunks, and end with the ramifications and capillary extremities, according to their ſeveral diviſions and ſubdiviſions, as before obſerved.

The veins of the thorax are alſo various, and proceed chiefly from the vena cava ſuperior, already ſpoken of. The principal branches are, vena coronariæ cordis, vena azygos vel ſine pari, venæ intercoſtales, pectoralis internæ, (from the latter ariſe the diaphragmaticæ ſuperiores, mediaſtinæ, mammariæ internæ, thymicæ, pericardiæ, and gutturales, or tracheales,) ſubclaviæ, jugulares, vertebrales. The coronary veins of the heart, the jugulars, and vertebrals are already deſcribed in the laſt ſection.

Vena azygos vel ſine pari.

The vena azygos, or ſine pari, is a vein ariſing within the thorax on the right ſide, having et venæ intercoſtales. having no fellow on the left; whence it is called azygos, or vena ſine pari. This vein is very conſiderable, and ariſes poſteriorly from the vena cava ſuperior, a little above the pericardium, and is immediately afterwards bent backward over the origin of the right lobes of the lungs; forming an arch which ſurrounds the great pulmonary veſſels on that ſide, as the arch of the aorta does thoſe of the left ſide, with this difference only, that the curvature of the azygos is almoſt directly backward, whereas that of the aorta is oblique. From thence it runs down on the right ſide the vertebræ dorſi, on one ſide of the aorta, and before the intercoſtal arteries; and getting behind the diaphragm, it terminates by a very ſenſible anaſtomoſis, ſometimes with the vena renalis, a neighbouring lumbar vein, or immediately with the trunk of the cava inferior, and ſometimes otherwiſe. I have ſeen this vein extremely large, reſembling the trunk of the inferior cava, from the diaphragm to the origin of the renales; the true cava being thro' all this ſpace very narrow, or of the ſize of an ordinary azygos. The vena azygos ſends out firſt of all, two or three ſmall veins from the top of the arch, one of which goes to the aſpera arteria, the others partly to the aſpera arteria, and partly to the bronchia, by the name of venæ bronchiales, accompanying the ramifications of the bronchial artery. Afterwards the azygos detaches from the extremity of the arch a ſmall trunk common to two or three ſmall veins, called intercoſtales ſuperiores dextræ, which bring back the blood from the firſt three ſeries of intercoſtal muſcles, and from the neighbouring part of the pleura. Theſe intercoſtal veins ſend branches through the intercoſtal muſcles to the ſerratus ſuperior poſticus, ſerratus major, &c. and afterwards they run along the interſtices between the ribs, communicating with the venæ mammariæ. They likewiſe ſend ſmall branches backward to the vertebral muſcles, and canal of the ſpine, where they communicate with the venal circles or ſinuſes which bring back the blood from the medulla ſpinalis.

As the azygos runs down, it ſends off the inferior intercoſtal veins on the right ſide, one going to each ſeries of intercoſtal muſcles: theſe veins run along the lower edges of the ribs, and perforate the muſcles by branches, which go to the poſterior and external part of the thorax. They communicate with the venæ thoracicæ, mammaria interna, and more or leſs with one another near the poſterior extremities of the ribs. The azygos ſends off likewiſe the left intercoſtal veins, but ſeldom the whole number; alſo ſix or ſeven, more or leſs, inferior intercoſtals, which run between the aorta and vertebræ, to the ſubſtance of which they give ſmall capillary twigs; they ſend off almoſt the ſame ramifications with the veins on the right ſide, and likewiſe ſome to the œſophagus; but ſometimes the diſtributions vary, and are not in all ſubjects alike. Juſt below the laſt rib, the azygos ſends off a large branch, which bending outward, perforates the muſcles of the abdomen, and is ramified there, communicating with the laſt two intercoſtal veins: ſometimes this extremity communicates either mediately or immediately

mediately with the vena adipoſa, and even with the vena ſpermatica.

The diaphragmaticæ ſuperiores, mediaſtinæ, mammariæ internæ, thymicæ, pericardiæ, and tracheales, are ſmall veins diſpoſed in pairs toward the right and left hand, behind the ſternum and parts near it, by ſome called venæ pectorales internæ. The diſtributions of theſe veins are much the ſame, both right and left, but they differ in their origin, becauſe of the inequality in the bifurcation of the cava ſuperior.

Venæ mediaſtinæ.

The right vena mediaſtina goes out anteriorly from the trunk of the ſuperior cava, a little above the origin of the azygos; the left comes from the ſubclavia.

Venæ diaphragmaticæ ſuperiores.

The right ſuperior diaphragmatica ariſes near the mediaſtina and its branches are diſtributed to the pericardium, communicating with thoſe of the left diaphragmatica, and accompanying the nerve of the ſame name. The left ſuperior diaphragmatica comes from the left ſubclavian, a little below the origin of the mammaria.

Venæ mammariæ internæ.

The right internal mammaria ariſes from the vena cava a little below the angle of the bifurcation. It runs along the poſterior edge of the ſternum, and on the cartilaginous extremities of the right ribs, together with the artery of the ſame name; it alſo ſends the diaphragm a branch and communicates with thoſe veins. Afterwards it gives ſmall branches to the mediaſtinum and others between the ribs to the integuments. The left internal mammaria ariſes anteriorly from the left ſubclavian, oppoſite to the cartilage or anterior extremity of the firſt true rib.

The right vena thymica, when it ariſes ſeparately, goes out from the bifurcation; this vein often reaches no lower than the inferior part of the thymus. The left vein of the ſame name comes from the left ſubclavian, almoſt oppoſite to the ſternum.

Venæ thymicæ.

The right pericardia ſeems to go out rather from the origin of the right ſubclavian, than from the trunk of the ſuperior cava; but in this there are many varieties. It goes to the upper ſide of the pericardium, and other neighbouring parts. The left pericardia comes ſometimes from the left ſubclavian, before the mammaria, and ſometimes from the mammaria or diaphragmatica ſuperior, on the ſame ſide.

Venæ pericardiæ.

The right tracheales goes out from the upper part of the bifurcation, above the mammaria of the ſame ſide, ſometimes more backward, and ſometimes from the ſubclavia. It is diſtributed to the glandulæ thyroideæ, thymus, and bronchiales, trachea arteria, and muſculi ſterno-hyoidæi: it communicates with the internal jugular vein. The left trachealis comes from the upper, or poſterior part of the left ſubclavian near its origin. The ſmalleſt internal pectoral veins do not always riſe ſeparately, but have ſometimes a ſmall common trunk, eſpecially on the right ſide; and of all theſe ſmall veins, the mammaria interna, is the moſt conſiderable.

Venæ tracheales.

The right ſubclavian vein, as has been already ſaid, is very ſhort and its courſe very oblique, ſo that it appears to riſe higher than the left vein. It ſends off, firſt of all, four large branches already mentioned, viz. the vertebralis, which is the firſt and moſt poſterior; the jugularis interna, jugularis externa,

Venæ ſubclaviæ.

terna, and axillaris. The left ſubclavian ſeems to aſcend but very little, after the bifurcation, becauſe it runs farther, and more tranſverſely than the right; and in this courſe it covers the origin of three large arteries, which come from the curvature of the aorta. It ſends off four large branches beſides the ſmall pectoral veins, and receives the ductus thoracicus. It likewiſe gives off, before its principal diviſion, a ſmall trunk for the left ſuperior intercoſtals, which are ſometimes ſix in number, and communicate with the inferior intercoſtals, and with a branch of the vena azygos. This ſmall common intercoſtal trunk furniſhes likewiſe the left bronchialis. Each ſubclavian vein, near the middle of the clavicula, ſends off a branch called cephalica, which deſcends near the ſurface of the body, between the deltoides and pectoralis major, and reaches the arm in the manner which ſhall be related hereafter.

Vena cava inferior.

The inferior vena cava having run down about a quarter of an inch from the right auricle of the heart, within the pericardium, as has been already ſaid, pierces that membrane, and the tendinous portion of the diaphragm which adhere very cloſely to each other. At this place it gives off the venæ diaphragmaticæ inferiores, or phrenicæ, which are diſtributed to the diaphragm, and appear chiefly on its lower ſide, one towards the right hand, and one toward the left. The right vein is more backward and lower than the left. The left is diſtributed partly to the pericardium, and partly to the diaphragm; and ſometimes they ſend branches to the capſulæ renales, much in the ſame manner as the arteriæ phrenicæ.

Venæ phrenicæ.

The other branches and ramifications of the inferior cava, are deſcribed hereafter in their proper place.

Nerves of the thorax.

The twelve pair of dorſal or coſtal nerves, all communicate with one another; as ſoon as they make their way out betwixt the vertebræ, each of them gives a poſterior branch to the muſculi erectores trunci corporis; the firſt, after having ſent off the brachial nerve, already deſcribed, is, after the ſame manner with the ſucceeding eight, beſtowed on the pleura and intercoſtal muſcles; the tenth and eleventh are moſt of them ſent to the abdominal muſcles; the twelfth communicates with the firſt lumbar, and is beſtowed on the muſculus quadratus lumbalis and iliacus internus.

Glands of the thorax.

The glands of the thorax are the glandulæ bronchiales, the thymus, and dorſalis. Beſides theſe, the œſophagus has a great number of glands, (eſpecially towards its upper part) as before obſerved; and it is common to find a little aperture or oſculum in the center of each, which has much more the appearance of an excretory duct.

Glandulæ bronchiales.

The glandulæ bronchiales are very obſervable glands, ſituated externally in the larger diviſions of the trachea and bronchia. They are of a blackiſh colour, and their uſe, like that of many others of the glands of this part of the body, is yet very little known.

It had been long ſuppoſed that they ſerved to ſecrete a liquid which they diſcharged into the bronchia, for the lubricating and moiſtening theſe parts; but Vercellonius will have it, that they ſecrete a fluid whoſe uſe is to be aſſiſtant in the digeſtion of our food, and that they diſcharge it into the œſophagus through certain extremely minute ducts.

Glandula dorſalis. Glandula dorſalis is a remarkable gland ſometimes found in the thorax, about the fifth vertebra of the back, adhering to the poſterior part of the œſophagus. It is, in different ſubjects, of various ſizes; being often of the ſize of a kidney-bean; ſometimes of that of an almond, and ſometimes conſiderably larger; in others, it is much leſs than the ſmaller, and ſometimes it is wholly wanting, or at leaſt ſo extremely minute and inconſiderable, that the beſt diſſectors are not able to find it. Sometimes alſo two glands are found in this part in the place of one. Vercellonius is of opinion, that this gland is alſo placed there for the ſecretion of a fluid ſerving to aſſiſt the digeſtion of our food in the ſtomach: but Fantonus, and ſome others, ſuppoſe, that theſe glands diſcharge a fluid of a mucous nature into the cavity of the œſophagus.

Glandula thymus. The thymus is a gland which, in infants is very remarkable: it is ſituated in the upper part of the thorax, immediately under the ſternum, and lies upon the pericardium, and on the trunk of the aorta, and of the vena cava. It extends itſelf from the pericardium along the trunk of the aorta, to the beginning of the carotids, ſometimes ſo far as to the thyroide gland; its figure is irregular and uncertain; its colour in infants is a pale red, in adults, it is of a duſkier hue: it is much larger in infants newly born, than in ſubjects at any more advanced period. Its length in the former is no leſs than three finger's breadth, and its diameter, two; its thickneſs is about half a finger: it gradually decreaſes from this ſize, as the child grows up; in adults it is very ſmall, and in old people it entirely diſappears. Its ſubſtance is glandular and conglomerate; and it is ſurrounded by a membrane. It has blood-veſſels of the ſame name, abovementioned: its lymphatics ſometimes run to the thoracic duct, ſometimes to the ſubclavian veins; and they have in general no valves. The nerves of the thymus are from the par vagum, or from the intercoſtals; there is ſometimes a milky juice found in this gland in new-born ſubjects. It has no excretory duct hitherto diſcovered, and its uſe is therefore not certainly known: poſſibly, according to Heiſter, it ſerves to ſecrete lymph, which it diſcharges into the thoracic duct, for the dilution of the blood and of the chyle, as the glands of the meſentery, and of the pancreas do, in regard to the chyle. On this ſuppoſition, its uſe is much greater in the fœtus, than at any time after the birth, becauſe the want of reſpiration in that ſtate may well be ſuppoſed to ſubject the blood to be thicker, and to need more dilution than afterwards; nothing tending to attenuate the blood ſo much as reſpiration.

Of the breaſts.

As the breaſts are ſituated in the external parts of the thorax, and come under the denomination of glands, I ſhall now deſcribe them.

Mammæ, or breaſts.

Mammæ, or the breaſts, are two glandular bodies, of a roundiſh oval figure, ſituated on the anterior, and a little towards the lateral parts of the thorax: theſe are moſt remarkable in women. In different perſons, ages, and ſexes, their ſize and figure is very various and uncertain. In very young, and very old perſons, they are always ſmall; alſo in virgins, and males of all ages; but in women with child, or thoſe who give ſuck, they are generally large, often very enormous. In children of both ſexes, and in males of all ages, they are commonly no more than cutaneous tubercles, or ſoft verrucæ, of a reddiſh colour, called papillæ, or nipples; each of them being ſurrounded by a ſmall, thin, and pretty broad circle, or diſk, more or leſs of a browniſh colour, and an uneven ſurface, termed areola. The time of the breaſts growing full in women, is about the age of fourteen, or that of puberty, which is ſometimes ſooner, ſometimes later; and the moſt natural time of their decreaſing is about the forty-ſeventh, or fiftieth year, when their menſes totally ceaſe, and the breaſts become flabby, loſing their natural conſiſtence and ſolidity. The breaſts, beſides the common integuments of the body (mentioned in the Introduction,) are compoſed of a glandular ſubſtance, and a multitude of lactiferous ducts, or ſmall tubes, which unite by frequent anaſtomoſes, and, as they approach the nipples, join and unite together, till at laſt they form, ſeven, eight, or more ſmall pipes, called tubuli lactiferi, which have ſeveral croſs canals, by which they communicate with each other; ſo that if any of them be obſtructed, the milk which was brought to it might not ſtagnate, but paſs through by the other pipes, which all terminate in the extremity of the nipple. The ſubſtance of the nipple is cavernous, almoſt like that of the human penis. The excretory ducts or tubes are larger in women who give ſuck, and are dilated into ſinuſes in many places, forming a kind of cells, which hold the ſecreted milk, and communicate with the veins and arteries. All theſe parts are to be ſeen much more diſtinctly in breaſts that are large and full of milk than in others; in young women, indeed, they are ſcarce to be diſtinguiſhed at all; as alſo in ſuch as have little breaſts, in ſuch as are emaciated, and in thoſe of very old people.

This glandular ſubſtance of the breaſts is ſeated in, and ſurrounded by, a great quantity of fat; which makes by much the greater part of the breaſts. The arteries and veins of the breaſts are called mammary veſſels, and are ſent from the ſubclavian and axillary veſſels; the former of theſe are called the internal, and the other the external ones. The nerves are from the dorſal ones of the ſpinal marrow. A fulneſs of the breaſts, eſpecially if there be milk found in them, is generally judged a mark of the loſs of virginity, and a proof that a woman has been with child; but this is not an infallible ſign.

The ſwelling of the breaſts during the time of geſtation, is owing to the conſent between the breaſts and the uterus; there being ſo near a communication between the mammary veſſels and the hypogaſtric veſſels of the womb, that a dilatation of the latter is attended with a ſimilar one in the former. For, the tubes which compoſe the glandular ſubſtance of the breaſts in maids, like a ſphincter muſcle, contract ſo cloſely, that no part of the blood can enter them; but when the womb grows big with a fœtus, and compreſſes the deſcending trunk of the aorta, the blood flows in a greater quantity, and with a greater force, through the arteries of the breaſts, and forces a paſſage into their glands, which being at firſt narrow, admit only of a thin water; but growing wider by degrees, as the womb grows bigger, the glands receive a thick ſerum; and after birth, they run with a thick milk, becauſe the blood, which before flowed to the fœtus, and for three or four days afterwards by the uterus, beginning then to ſtop, dilates the mammillary glands, and conſequently ſwells the breaſt.

CHAP. V.

SECT. I.

Of the ABDOMEN and its Parts.

Abdomen and its parts.

THE abdomen begins immediately under the thorax, and terminates at the bottom of the pelvis of the oſſa inominata. Its circumference, or outer ſurface is divided into regions, of which there are three anterior, viz. the epigaſtric, or ſuperior region, the umbilical, or middle region, and the hypogaſtric, or lower region. There is but one poſterior region, named regio lumbaris.

The epigaſtric region begins immediately under the appendix enſiformis, at a ſmall ſuperficial depreſſion, called the pit of the ſtomach, and in adult ſubjects ends above the navel at a tranſverſe line, ſuppoſed to be drawn between the laſt falſe ribs on each ſide. This region is ſubdivided into three parts, one middle, named epigaſtrium, and two lateral, termed hypochondria. The epigaſtrium takes in all that ſpace which lies between the falſe ribs of both ſides, and the hypochondria are the places covered by the falſe ribs.

The umbilical region begins in adults, above the navel, at the tranſverſe line already mentioned, and ends below the navel at another tranſverſe line, ſuppoſed to be drawn parallel to the former, between the two criſtæ of the oſſa ilium. This region is likewiſe divided into three parts, one middle, which is properly the regio umbilicalis, and two lateral, called ilia, or the flanks; and they comprehend the ſpace between the falſe ribs and upper part of the os ilium on each ſide.

The hypogaſtric region is extended downward from the inferior limit of the umbilical region, and is alſo divided into three parts, one middle, called pubis, and two lateral, called inguina, or the groins.

The lumbar region is the poſterior part of the abdomen, and comprehends all that ſpace which reaches from the loweſt ribs on each ſide, and the laſt vertebra of the back, to the os ſacrum, and neighbouring parts of the oſſa ilium. The lateral parts of this region are termed the loins, but the middle part has no proper name in men.

The bottom of the abdomen, which anſwers to the pelvis of the ſkeleton, is terminated anteriorly by the pudenda, or parts of generation, and poſteriorly by the buttocks and anus. The buttocks are ſeparated by a foſſa, which leads to the anus, and each buttock is terminated downward by a large fold, which diſtinguiſhes it from the reſt of the thigh; this lumbar region takes in likewiſe the muſculus quadratus lumborum on each ſide, the lower portions of the ſacro-lumbares, of the longiſſimi and latiſſimi dorſi, the muſculus ſacer, &c. The ſpace between the anus and the parts of generation is called perinæum, and is divided into two equal lateral parts by a very diſtinct line, which is longer in males than in females, as we ſhall ſee in another place. The cavity of the abdomen, formed by the parts already mentioned, (all which are covered by the ſkin and membrana adipoſa) is lined on the inſide by a particular membrane, called peritonæum. It is ſeparated from the cavity of the thorax by the diaphragm, and terminated below by the muſculi levatores ani. This cavity contains the ſtomach, and the inteſtines, which are commonly divided into three ſmall parts, named duodenum, jejunum and ilium; and three large, called cœcum, colon, and rectum. It contains likewiſe the meſentery, meſocolon, omentum, liver, gall, bladder, ſpleen, pancreas, glands of the meſentery, vaſa lactea, receptaculum chyli, kidneys, renal glands, ureters, bladder, and the internal parts of generation in both ſexes. Alſo the following bones pertaining to this lower venter, viz. the five vertebræ of the loins, os ſacrum, os coccygis, and oſſa inominata which contain the ilium, iſchium, and pubis. Theſe bones, below the vertebra, form the pelvis or baſon, which is much larger in women than in men, to give room for the growth, &c. of the fœtus. The external parts of generation may be alſo here deſcribed, as they likewiſe belong to the abdomen.

SECT.

SECT. II.

Of the BONES pertaining to the ABDOMEN.

Bones pertaining to the abdomen.

THE bones belonging to the abdomen are the vertebræ of the loins, (which are the five lowermoſt vertebræ of the ſpine, or back-bone, and complete the whole twenty-four. See thoſe of the neck and thorax, before deſcribed); the os ſacrum, os coccygis, oſſa inominata or pubes, which conſiſts of the ilium, iſchium, and pubis.

Vertebræ of the loins.

Firſt, of the vertebræ; ſee a general deſcription in Chap. iii. Sect. 2. The five vertebræ of the loins differ from the reſt in this, that they are the broadeſt, and the laſt of them is the largeſt of all the vertebræ. Their acute proceſſes are broader, ſhorter, and wider from one another, their tranſverſe longer to ſupport the bowels and the muſcles of the back; they are not perforated as thoſe of the neck, nor have they a dimple or ſinus as thoſe of the back. The cartilages which are betwixt their bodies are thicker than any of the reſt. The middle vertebræ of the loins are again bent forwards under the center of gravity or near it; and from thence they go backwards to the os ſacrum, where being fixed to the oſſa inominata behind the center of gravity, the articulation is therefore firm and without motion, and from thence the oſſa inominata are ſo formed, as that their ſockets into which the thigh bones are fixed, where there is a free motion, are exactly under the center of gravity. The greateſt motion of the back is performed by the vertebræ of the loins, becauſe their cartilages are thicker and their acute proceſſes are at a greater diſtance from one another; for the thicker the cartilages are, the more we may bend our body forwards; and the greater diſtance there is betwixt the acute proceſſes, the more we may bend ourſelves backwards.

Some have given particular names to the vertebræ of the back and loins; but this is not neceſſary, as they are ſufficiently diſtinguiſhed by numbering them.

Os facrum. The os ſacrum is the lower extremity of the ſpina dorſi, the vertebræ of which grow ſo cloſe together in adults, as that they make but one large and ſolid bone of a triangular figure, whoſe baſis is tied to the laſt vertebræ of the loins, and the upper part of its ſides to the ilia, and its point to the os cocygis. This bone in infants is almoſt entirely cartilaginous; and in children more grown up, it always conſiſts of ſeveral pieces, the junctures of four or five of which may be ſeen even in adults, though it be one continued bone. The os ſacrum is concave and ſmooth on its fore-ſide, but convex and rough on its back-ſide, and is of a ſpongy ſubſtance: it hath four or five holes on each ſide, which give paſſage to the nerves of the inteſtinum rectum, bladder, and parts of generation, and to the large crural and iſchiatic ones.

Its acute proceſſes or ſpines are ſhorter and leſs than thoſe of the loins, and the lower is always ſhorter than the upper. The uſes of this bone are to ſerve as a baſis for the ſpine; to form the pelvis along with the oſſa inominata, and to defend the parts contained in it; to ſerve as a place of origin to many of the muſcles; to contain in its canal or ſinus, the lower part or end of the ſpinal marrow, called cauda equina; and likewiſe to give paſſage to the nerves above-mentioned.

Os coccygis. The os coccygis is joined to the extremity of the os ſacrum, and is compoſed of three or four bones, like falſe vertebræ joined together by cartilages more or leſs pliable; but ſometimes all the pieces are entirely cemented together. The lower piece is ſtill leſs than the upper, till the laſt ends in a ſmall cartilage, which reſembles a little tail turned inwards. Its uſe is to ſuſtain the rectum inteſtinum; it yields to the preſſure of the fœtus in women in travail, and midwives ſometimes thruſt it rudely and violently backwards, which occaſions great pain and ſeveral bad effects.

Oſſa innominata. Oſſa innominata are compoſed of three bones in young ſubjects, each of which has its peculiar name; the upper one is called the ilium, (the inteſtine ilium lying between it and its fellow), the anterior one the os pubis, and the lower and poſterior one the os iſchium. Theſe are joined by the intervention of a cartilage, as it were in the middle of that ſingular cavity called the acetabulum, or ſocket for the thigh-bone, and continue viſibly diſtinct to the age of puberty; after which they coaleſce, and form one entire bone ſo perfectly, that there is not the leaſt veſtige remaining that they ever were ſeparate. The oſſa innominata are joined on each ſide, in the hinder part, to the os ſacrum, forming a very firm and ſtrong, tho' ſomewhat moveable, articulation with it; and with this bone they alſo form the cavity called the pelvis. The upper edge of the ilium is called its ſpine, the anterior part of the ſpine its apex, and a little lower is the proceſſus innominatus. The uſe of theſe bones is to ſupport and ſuſtain the ſpina dorſi, and indeed all the parts above them; to make a firm and proper juncture of the other parts of the body with the thighs; to ſerve for the place of origin to ſeveral muſcles; to form the cavity of the pelvis, and to defend its contents from external injuries.

In the centre of theſe bones is the acetabulum coxendicis, or ſocket for the thigh bone; in the bottom of which ſocket is another cavity, in which lies the mucilaginous gland of this joint. When impoſtumations happen in this joint they uſually cauſe a great ſwelling and lameneſs in the hip, which in time makes a collection of matter in the external part of the hip, &c.

SECT. III.

Of the CARTILAGES, LIGAMENTS, &c. pertaining to the ABDOMEN.

Cartilages of the oſſa innominata

THE true cartilages of the oſſa inominata in adult ſubjects, are five in number, three common, and two proper.

The firſt and principal common cartilage is that which makes the ſympyhſis of the oſſa pubis; reaching from the interval between the ſpines of theſe two bones, all the way to the angle where they begin to ſeparate; it fills the angle already mentioned, and forms a kind of arch, which is more conſiderable in women than in men. The two other common cartilages join the oſſa ilium to the os ſacrum, but are thinner than that of the oſſa pubis. The proper cartilages are thoſe that line the cotyloide cavities. In the edge of each cavity there is a notch or opening between the anterior and inferior parts; and in the cavity itſelf, there is a broad unequal ſhallow depreſſion, reaching from the notch, beyond the middle of the cavity. All the reſt of the ſurface of the acetabulum coxendix is covered with a very white, ſhining, ſmooth cartilage, which terminates preciſely at the edge of the cavity. The circumference of the acetabulum has beſides a border of a particular kind, the ſubſtance of which is neither wholly cartilaginous, nor wholly ligamentary; but I chooſe to place it among the ligaments.

Ligaments of the oſſa innominata.

The ligaments of the oſſa innominata are of two kinds, common and proper. The common ligaments are thoſe which go between theſe and the neighbouring bones, of which there is a conſiderable number, viz. one ſuperior ligament from the poſterior edge of the os ilium to the tranſverſe apophyſis of the laſt vertebra of the loins; one inferior and anterior ligament, from the inner ſide of the angle of the criſta or border of the os ilium, to the ſuperior and anterior part of the firſt falſe tranſverſe apophyſis of the os ſacrum. Several inferior and poſterior go from along the internal edge of the ſpine of the criſta of the os ilium to the firſt three falſe tranſverſe apophyſes. To theſe muſt be added the ligaments by which the os femoris is joined to the os innominatum, which ſhall be deſcribed among the other ligaments of the thigh. The principal proper ligaments are four in number, two called ſacro-ſciatic, one broad and external, the other ſmall and internal, one obturator and one inguinal.

The broad ſacro-ſciatic or internal ſciatic ligament proceeds from the inſide of the ſpine of the criſta of the os ilium to the falſe tranſverſe apophyſes of the os ſacrum, and the ſpine of the iſchium, and from thence it produces a kind of ligamentary falx, one edge lying looſe, which, with the bones, forms a groove along the internal inferior portion of the iſchium.

The internal ſciatic ligament adheres cloſely to the inſide of the poſterior portion of the former, going from the fourth falſe tranſverſe apophyſis of the os ſacrum, all the way to the upper part of the os coccygis, and is fixed in the ſharp point of the ſpine of the iſchium. By theſe two ligaments two diſtinct openings are formed, a large one with the ſuperior ſciatic ſinus, and a ſmall one with the inferior ſciatic notch. The obturator ligament fills up all the great foramen ovale, except the oblique notch at its proper part. On the inſide of the upper and anterior part of the os pubis there is a tranſverſe ligament, reſembling the ſhape of a pent-houſe, fixed by its upper part to the os pubis, from the oblique notch of the foramen ovale all the way to the lower part of the ſymphyſis. The inguinal ligament, called from the diſcoverer, ligamentum Fallopii, is an aponeurotic or ligamentary band, faſtened by one end to the anterior and ſuperior ſpine of the os ilium, and by the other to the ſpine of the os pubis.

Another ligament runs tranſverſely between the two angles of the cotyloide notch.

The rough unequal depreſſion at the bottom of the acetabulum, or ſocket for the thigh bone, is filled by a broad flat mucilaginous gland, bordered with a fatty ſubſtance, and covered by a fine membrane, through which a mucilaginous liquor paſſes to moiſten the joint and facilitate its motions. This membrane riſes above the gland, and gives a ſort of covering or coat to the ligament contained in the joint; the blood-veſſels of the gland paſs between the bottom of the cotyloide notch, and the tranſverſe ligament thereof. Mucilaginous glands of the os innominata.

S E C T. IV.

Of the MUSCLES of the ABDOMEN.

I Think it neceſſary here to obſerve, that with the muſcles of the abdomen I ſhall alſo here deſcribe thoſe of the genital parts, anus, and perinæum. The muſcles peculiar to the abdomen only are five pair, (excluſive of the diaphragma, and triangularis ſterni, already ſpoken of with the muſcles of the thorax.) Muſcles of the abdomen.

Obliquus aſcendens vel externus ariſes from the eight inferior ribs, the upper part of its origin being indented with the ſerratus major anticus, and the lower lying under a ſmall portion of the latiſſimus dorſi. It is inſerted into the ſpine of the ilium, into the os pubis, and linea alba, which is a ſtrong tendinous line extended from the os pubis to the ſternum, between the muſculi recti. Obliquus aſcendens vel externus.

Obliquus deſcendens vel internus.

Obliquus deſcendens vel internus ariſes under the former muſcle of the ſpine of the ilium, os ſacrum, and ſpines of the loins, and is inſerted partly into the lower ſide of the ſpurious ribs, and by a flat tendon into the ſternum and linea alba, together with the tendon of the aſcendens.

Pyramidalis.

Pyramidalis is a ſmall muſcle lying in the lower part of the rectus. It has its name from its figure, and its origin from the margin of the os pubis, with a broad fleſhy head, whence it grows gradually narrower, till it ends in a ſmall round tendon in the linea alba about three or four inches below the navel. This muſcle is ſometimes ſingle, ſometimes it has its fellow, and in ſome ſubjects they are both wanting.

Rectus abdominis.

Rectus abdominis ariſes from the ſternum near the cartilago enſiformis, and the extremity of the two laſt ribs. It goes ſtrait down to the fore-part of the abdomen, and is inſerted into the os pubis.

Tranſverſalis abdominis.

Tranſverſalis abdominis ariſes from the cartilago enſiformis, the extremities of the falſe ribs, and the tranſverſe apophyſis of the vertebræ of the loins; it is fixed to the innerſide of the ſpine of the ilium and then, becoming a flat tendon, it paſſes under the rectus, and is inſerted into the os pubis and linea alba. Between this tendon and the peritonæum, ſometimes water is found in great quantities, conſtituting a dropſy in the duplicature of the peritonæum; which ſhews this membrane has been miſtaken for part of the peritonæum. The uſes of theſe abdominal muſcles are to ſuſtain the viſcera of the abdomen, and to compreſs the parts contained therein, in order to clear it of what ought to paſs off by the natural outlets, to relieve the ſtomach by vomiting, from whatever might be hurtful to it; and laſtly to drive out by a violent expiration whatever may incommode the organs contained in the thorax. The obliquus deſcendens on the right ſide, and aſcendens on the left, acting together turn the upper part of the trunk of the body towards the left, and vice verſa; but the trunk is chiefly turned upon the thighs; the recti bend the body forward, and pull the ſternum downward in expiration; the two oblique muſcles and the tranſverſe on each ſide near the groins, are perforated to let through the proceſſus vaginalis with the ſpermatic veſſels. Theſe perforations are diſtant from each other, ſo as to ſuffer the veſſels to deſcend conveniently into the ſcrotum: this way the inteſtines or the omentum deſcend in ruptures.

Cremaſter teſtis.

Cremaſter teſtis is a muſcle ſo called, becauſe (with its fellow) it ſuſpends the teſticles, and draws them up in the act of generation. It ariſes fleſhy from the loweſt and fore-part of the os ilium, and upper part of the ligamentum pubis: its fibres running parallel with thoſe of the obliquus aſcendens, and almoſt encompaſſing the proceſs of the peritonæum (which ſurrounds the ſpermatic veſſels as they come out of the abdomen) deſcends with it, and is inſerted into the tunica vaginalis, upon which it is ſpread in ſeveral diſtinct portions. See Chap. viii. Sect. 2.

Erector penis.

Erector penis and its fellow, are muſcles that ſerve for the erection of the penis. Theſe ariſe on each ſide from the oſſa iſchii between the tubercle of this bone and the beginning of the corpus cavernoſum, and each of them is inſerted into the corpus cavernoſum of the ſame ſide. Theſe muſcles when they act together, preſs the veins of the back of the penis againſt the os pubis, by which they prevent the reflux of blood from the penis; and conſequently when at the ſame time the blood flows impetuouſly into the part by the arteries, and cannot get back this way, the penis becomes extended and erect. See Chap. viii. Sect. 2.

Accelerator urinæ.

Accelerator urinæ ariſes tendinous from the oſſa iſchia, and fleſhy from the ſphincter ani; or, according to Mr. Cowper, from the ſuperior part of the urethra as it paſſes under the os pubis: and thence being expanded over the bulb of the urethra, it afterwards divides, and is inſerted into the penis. The uſe of this muſcle is not to accelerate the urine, for that is propelled by the detruſor urinæ, or muſcular coat of the bladder, but to protrude the ſemen, which is done only by this. They likewiſe aſſiſt the erectores in the erection of the penis, by driving the blood contained in the cavernous body of the urethra towards the glands, which is thereby diſtended; the tumefaction of theſe muſcles at the ſame time compreſſing the veins that carry off the refluent blood from the corpus cavernoſum.

Tranſverſalis penis.

Tranſverſalis penis vel perinæi is one of the dilators of the urethra, ariſing from the tubercle of the os iſchium on each ſide, and inſerted into the poſterior part of the bulb of the urethra. Theſe muſcles, however, are not quite determinate and certain in their origin or inſertion, and ſometimes they are wholly wanting. When they act, they dilate the urethra in its poſterior part.

Sphincter veſicæ urinariæ. Sphincter veſicæ urinariæ is compoſed of a ſeries of tranſverſe fibres running croſswiſe, under the ſtrait fibres of the neck of the bladder, in form of a circle, and ſerving to cloſe it, to prevent the involuntary diſcharge of the urine, In men this is connected to the fibres of the inteſtinum rectum, and in women to thoſe of the vagina.

Detruſor urinæ. Detruſor urinæ is the muſcular coat of the bladder; its fibres are differently diſpoſed, but chiefly terminating in the ſphincter veſicæ, whereby it not only preſſes the urine forward, but, when the bladder is full, becomes an antagoniſt to the ſpincter, acting almoſt at right angles.

Erector clitoridis. Erector clitoridis ariſes from the iſchium, and is inſerted into the corpora cavernoſa of the clitoris, like the erector penis in men, and is ſaid to cauſe erection in the ſame manner.

Sphincter vaginæ. Sphincter vaginæ is compoſed of a ſeries of muſcular fibres ariſing from the ſphincter ani, and ſurrounds the orifice of the vagina; after which it is inſerted under the crura of the clitoris. Its uſe is to conſtringe the orifice of the vagina, to preſs out a liquor from the glands of the vagina, and embrace the penis in coition. Dr. Douglas mentions two pair of muſcles of the vagina of his own diſcovering; but as I have never yet ſeen them in diſſection, I ſhall omit their deſcription, and refer the reader to that author.

Sphincter ani. Sphincter ani is a muſcle near two inches broad, compoſed of circular fibres, which cloſes the extremity of the inteſtinum rectum,

and

and forms the anus. It is connected forward with the accelerator urinæ in men, and with the neck of the uterus in women; and backwards with the os coccygis. This muſcle ſurrounds the anus to cloſe it, and to prevent involuntary falling out of the fæces.

Elevator ani. Elevator ani ariſes from the oſſa iſchii, pubis, and ſacrum, within the pelvis, and is inſerted round the lower end of the inteſtinum rectum. It ſurrounds alſo the collum veſicæ, glandulæ proſtatæ, and veſiculæ ſeminales in men, and the vagina in women. The uſe of this muſcle (which Dr. Douglas divides into two pair) is not only to ſuſtain and elevate the anus, leſt the fæces ſhould be burthenſome to the ſphincter, but to preſs the proſtatæ and veſiculæ ſeminales, in order to promote the emiſſion of the ſeminal juices in coition.

Fiſtulæ in ano, that are within this muſcle, generally run in the direction of the gut, and may be laid open into the gut with great ſafety; but thoſe fiſtulæ or rather abſceſſes that are frequently formed on the outſide of the ſphincter, and uſually ſurround it, all but where this muſcle is connected to the penis, cannot be opened far into the gut, without totally dividing the ſphincter, which, authors ſay, renders the ſphincter ever after incapable of reſtraining the excrement: but this does not always hold true; for there have been many inſtances of the ſphincter being divided, which made the patients unable to hold their excrements during their cure, but the wounds being healed, they have retained them as well as ever.

Intertranſverſales lumborum are ſmall muſcles ſeated between all the tranſverſe proceſſes of the vertebræ lumborum, to bring them nearer together. Intertranſverſales lumborum.

For the interſpinales lumborum, &c. ſee extenſor dorſi et lumborum.

Pſoas parvus is one of the flexor muſcles of the loins, which ariſes laterally from the body of the upper vertebra of the loins, and the laſt of the back, and is inſerted into the os pubis, where it is joined to the ilium. It either aſſiſts in bending the loins, or the quadratus in elevating the oſſa innomina, eſpecially when we lie down. This muſcle is often wanting. Pſoas parvus.

Quadratus lumborum has its origin in the anterior and ſuperior part of the poſterior proceſs of the ilium, and is inſerted into all the tranſverſe proceſſes of the vertebræ of the loins, the laſt vertebra of the thorax, and the laſt rib. This, with its fellow, acting alternately, aſſiſt the extenſor dorſi et lumborum in raiſing the oſſa inominata in progreſſion: or each acting ſingly, while the lower limbs are not moved, inclines the body to one ſide. Quadratus lumborum.

Coccygei ariſe from the acute proceſſes of the oſſa iſchii, and are inſerted into the os coccygis, which they pull forward. For the pſoas magnus iliacus internus, &c. ſee the Muſcles of the Thigh, Chap. viii. Sect. 4. Coccygei.

SECT. V.

Of the VISCERA, &c. of the ABDOMEN.

Viſcera of the abdomen.

THE viſcera of the abdomen, beſides the ſtomach and alimentary duct, are the inteſtinum duodenum, jejunum, and ilium; alſo the cæcum, colon, and rectum: the meſentery, meſocolon, omentum, liver, gall-bladder, ſpleen, pancreas, glands of the meſentery, vaſa lactea, receptaculum chyli, kidneys, renal glands, ureters, bladder, uterus, and the internal parts of generation.

Peritonæum.

The peritonæum is a thin, ſoft, ſmooth, and lubricous membrane, which lines the whole cavity of the abdomen, containing moſt of the viſcera of that part, as it were in a bag. It has a number of ſmall glands that ſeparate a liquor which ſupplies the inteſtines, and facilitates their motion: the external ſuperficies of this membrane is unequal where it adheres to the tranſverſe muſcles, but the internal is very ſmooth and poliſhed. The upper part of the peritonæum covers the diaphragm or midriff, to which it cloſely adheres, and is no other than the proper membrane of the diaphragm, for (as Cheſelden obſerves) there is no more reaſon to call that a part of the peritonæum, than there is for calling the membrane on the other ſide of the diaphragm, part of the pleura or mediaſtinum. The fore-part of the peritonæum ſticks to the tranſverſe muſcles, and linea alba; the lower part of it to the os pubis, and the back part of it to the os ſacrum and vertebræ of the loins. It is a double membrane, and contains in its duplicatures the umbilical veſſels, the bladder, ureters, kidneys, and the ſpermatic veſſels, to all which it gives a membrane, as alſo, to the liver, ſpleen, ſtomach, inteſtines, and womb. Its external laminæ have two productions or proceſſes, named proceſſus vaginalis, which reſemble two ſheaths, paſſing through the rings of the oblique and tranſverſe abdominal muſcles in the groin, to encloſe the ſpermatic veſſels and teſticles in men, and the round ligaments of the womb in women. The arteries and veins of the peritonæum are ſupplied from the epigaſtric, mammary, lumbar, and diaphragmatic veſſels; and often from the ſpermatics. Its nerves are from thoſe of the diaphragm, back, loins, and os ſacrum. It has alſo a few lymphatics, which diſcharge themſelves into the iliac glands. The uſes of the peritonæum are, to encloſe the contents or viſcera of the abdomen; for when it is dilated, wounded, or broken, they fall out of their proper places, and ruptures are formed. It alſo gives an external covering to almoſt all the parts contained in the abdomen, which are therefore generally ſaid to have their external membrane from the peritonæum; and forms the proceſs of the peritonæum, and the tunica vaginalis of the teſtes.

The dropſy of the peritonæum may be diſtinguiſhed by being leaſt prominent about the navel, for there the tendons of the muſcles and the peritonæum will not ſeparate; and the water, in ſome that have been diſſected, has been found to have made the parts where it was contained as foul as any ulcer; therefore,

fore, none of them could have been cured by operation.

Omentum epiploon, or cawl.

Omentum epiploon, or cawl, is a fine membrane larded with fat, ſomewhat like net-work. It is ſituated under the peritonæum, and immediately above the inteſtines on the ſurface of the ſmall guts, and reſembles an apron tucked up. Its outer or upper part, named ala ſuperior, is connected to the bottom of the ſtomach, the ſpleen, and part of the inteſtinum duodenum; and thence deſcending a little lower than the navel, is reflected and tied to the inteſtinum colon, the ſpleen, and part of the duodenum; this laſt part is called ala inferior; and the ſpace between the alæ is named burſa. Sometimes both alæ are tied to the liver, and in diſeaſed bodies to the peritonæum. The uſes of the omentum are, to lubricate the inteſtines, that they may the eaſier perform their periſtaltic motion; and to cheriſh and defend them from cold; to aſſiſt in the formation of the bile, the fatty part of which is wholly owing to the veſſels of the omentum; every thing (according to Malpighi) that returns from this part going to the liver through adipoſe ducts to the vena portæ. It ſerves alſo to temperate the acrimony of the humours, and, probably, to give nouriſhment to the body, as all the other fat is ſuppoſed to do, when it is incapable of being nouriſhed any other way. The arteries of the omentum come from the cæliac, and are very numerous; its veins ariſe chiefly from the ſplenic branch of the vena portæ; and its nerves are from the intercoſtals and par vagum.

Ventriculus. The ſtomach.

Ventriculus, or the ſtomach, is a hollow membranous part, placed moſtly in the left hypochondrium, immediately under the left ſide of the diephragm, its left ſide touching the ſpleen, and its right being covered by the thin edge of the liver. Its figure nearly reſembles the pouch of a bag-pipe, its left end being moſt capacious, the upper ſide concave, and the lower convex; it has two orifices, both on its upper part: the left, called cardia, is placed much higher than the right, continuous to the gula, through which the aliment paſſes into the ſtomach. Its right orifice is called the pylorus, through which the aliment is conveyed out of the ſtomach into the duodenum. In this part, there is a circular valve which cloſes the ſtomach, and hinders a return of aliment out of the gut, but does not at all times hinder the gall from flowing into the ſtomach. The pylorus is connected to the upper part of the ſtomach by a ligament. The ſize of the ſtomach in human ſubjects is various; in people addicted to gluttony it is uſually very large: and in men it is generally larger than in women. Its veſſels are arteries, veins, nerves, and lymphatics. The gaſtric arteries it receives from the cœliac; and the gaſtric veins all run to the vena portæ; among theſe are obſervable the vaſa brevia, which go off to the ſplenic branch, and the vena coronaria which ſurrounds the ſtomach Its nerves principally enter at the left orifice; they come from the par vagum, and are very large, whence it is, that the ſtomach is ſo ſenſible: the lymphatics go to the receptaculum chyli. The ſubſtance of the ſtomach is membranaceous, and is compoſed of four coats, as the œſophagus. The firſt, or external coat, is membranous, the fibres of which run tranſverſely; the ſecond coat is muſcular, whoſe fibres are chiefly longitudinal and circular; the third is nervous; this forms a multitude of wrinkles, and is furniſhed with a number of ſanguiferous veſſels, and ſmall glands, which ſecrete a mucus. The fourth coat is thin, villoſe, and porous, and adheres very firmly to the former. As the muſcular coat of the ſtomach contracts, the inner coat falls into folds, which increaſe as the ſtomach leſſens, and conſequently retard the aliment moſt when the ſtomach is neareſt being empty. The uſe of the ſtomach is for the digeſtion of our food, that is, to receive, contain, diſſolve, and change what is ſwallowed by the mouth; and after a ſufficient concoction, to expel it through the pylorus into the inteſtines; poſſibly it alſo abſorbs, and retains the moſt ſubtle parts of what it has thus prepared for nutrition. It is alſo the organ in which the ſenſation of hunger reſides. See Chap. viii. Sect. 7.

Duodenum. The duodenum is the firſt of the three ſmall guts, ſo called from its being about twelve fingers breadth in length. It begins from the pylorus, from which turning downwards, it firſt paſſes by the gall-bladder, and then under the following gut and meſentery, and coming in ſight again in the left hypochondrium, it there commences jejunum, which is the ſecond of the ſmall guts; but the place where this ends and the other begins is not exactly determined. About four fingers breadth from the pylorus it receives at one prominent hiatus or mouth, a duct from the liver and gall-bladder, called ductus communis choledochus, and another from the pancreas, called pancreaticus, at a little diſtance from each other, which diſcharge their reſpective liquors into it. The coats of the duodenum are thicker than thoſe of any other of the ſmall guts, its cavity is alſo greater, and its paſſage in a ſtraiter direction than any of them. Near its origin it has no valves, nor rugæ or wrinkles; but in its continuation it has very numerous and remarkable ones, called by authors juga. It has alſo the glands of Brunnerus in great number, which ſerve for the ſecreting of a thin aqueous fluid: and it receives an artery from the cœliac and a vein from the porta.

Jejunum. The jejunum is ſo called from its being uſually found empty, which is owing to the fluidity of the chyle, the greater ſtimulus of the bile in it, and the abundance of the lacteal veſſels with which it is furniſhed. It is ſituated in the regio umbilicalis, and being the ſecond of the ſmall guts, it begins where the duodenum ends, and terminates where the valves are obliterated. Its length is different in various ſubjects; but is uſually between thirteen and ſixteen hands breadth long, making ſomewhat more than a third part of the ſmall guts. It is diſtinguiſhed from the ilium by its coats, which are a ſmall matter thinner, and leſs pale; it receives arteries from the meſentericæ, and veins from the meſaraicæ, and has alſo a great many connivent glands and valves.

Ilium. The ilium is the continuation of the former, and is the third and laſt of the ſmall guts. It is ſituated in the hypogaſtrium, and very often ſome part of it in the pelvis, upon the bladder, eſpecially in women; filling all the ſpace between the ilia, whence its name. Its length is various; ſometimes not more than fifteen, ſometimes twenty-one hands breadth long, or more. Its beginning is where the valves of the jejunum ceaſe to be conſpicuous, and its end is where the larger inteſtines begin; in which place, it is in a very ſingular manner inſerted into the right ſide of the colon, near the upper edge of the os ilium. It has no other valves except that great one at the end, which is called by many, valvula coli Bauhini: its glands are, in general, more numerous towards the end than in any other part. The great length of the ſmall guts is evidently for the convenience of a greater number of lacteals, that the chyle which miſſes their orifices in one place may not eſcape them in another. This inteſtine, becauſe of its ſituation, falls eaſily down into the ſcrotum, by the production of the peritonæum.

Great guts. The thick and great guts are the cæcum, colon, and rectum; but the cæcum here meant is the head of the colon.

Cæcum. The cæcum, or apendicula vermiformis, is, I think, the only true cæcum, though the antients deſcribe it otherwiſe. It is ſituated on the beginning of the colon, and is properly an appendage of that gut. It is about four or five fingers breadth long, and the bigneſs of an earth-worm, or gooſe-quill, with a ſmall orifice opening into the colon: this gut has ſeldom any thing in it. It is called cæcum, or blind, becauſe it is open only at one end, by which it is fixed to the beginning of the colon; its other end, which is ſhut, is not tied to the meſentery, but to the right kidney, by means of the peritonæum.

næum. In human ſubjects, the cæcum is called one of the large guts, though it is the ſmalleſt by far; but the miſtake ariſes from following the ancients, whoſe deſcriptions of all the parts contained in the abdomen, ſeem to be taken from dogs; for in them, and in many other animals, it is very large, as Cheſelden obſerves.

Colon. The colon may be reckoned the firſt of the great guts, according to the above account. It is the greateſt and wideſt of all the inteſtines, and about eight or nine hands-breadth long. It begins where the ilium ends, in the cavity of the os ilium, on the right ſide; from thence, aſcending by the kidney on the ſame ſide, it paſſes under the concave ſide of the liver, to which it is ſometimes tied, as likewiſe to the gall-bladder, which tinges it yellow in that place; then it runs under the bottom of the ſtomach to the ſpleen, in the left ſide, to which it is alſo knit; from thence it turns down to the left kidney; and thence, paſſing in form of an S, it terminates in the upper-part of the os ſacrum, in the rectum. At the beginning of this gut there is a valve formed by the production of the inmoſt coat of the inteſtines, in this place; it hinders the excrements, which are once fallen into the colon, from returning again to the ilium. It has a ſtrong ligament, which, running along its upper ſide from the ilium to the rectum, ſtrengthens it againſt the weight of the excrements, and draws it together into the cells, which, with the valvulæ conniventes, retards the paſſage of the excrements, that we may not be obliged continually to go to ſtool. The fleſhy fibres of its ſecond coat are greater and ſtronger than

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thoſe of the other inteſtine, becauſe greater ſtrength is requiſite to cauſe the excrements to aſcend. The connivent valves are larger in this than in any other of the guts, as well as the coats ſtronger.

Rectum. The rectum is the laſt of all the inteſtines. It is about two hands-breadth long, and three fingers-breadth broad; it begins at the upper part of the os ſacrum, where the colon ends, and going ſtrait down (whence its name) it is tied to the extremity of the coccyx, by the peritonæum behind, and to the neck of the bladder in men, but in women to the vagina uteri before, from whence comes the ſympathy between thoſe parts. The coats of the rectum are more thick and fleſhy than thoſe of any other of the inteſtines: it has in general no valves, but ſeveral rugæ; the abſence of valves here, is to prevent the expulſion of the fæces from being retarded. The extremity of this gut forms the anus. The lower end of this gut is the ſeat of the true fiſtula in ano, which uſually runs betwixt the muſcular coat and the inner coat; it is cured by opening it the whole length into the cavity of the gut; it is yet better, if it can be done, to extirpate all that is fiſtulous and ſchirrous, for that is a ſure way to make one operation perfect the cure, as an eminent ſurgeon juſtly obſerves. The other kind of fiſtula, improperly ſo called, is an abſceſs running round the outſide of the ſphincter, in the ſhape of a horſe-ſhoe, being a circle all but where this muſcle unites with thoſe of the penis; this is beſt cured by opening and removing part of the outer ſkin. The former of theſe caſes happens ofteneſt in full habits, proceeding frequently from the piles;

the latter is generally a critical diſcharge, and one of Nature's laſt efforts in conſumptive and ſcorbutic habits of body. The inverſion and ſliding down of this gut is called prolapſus ani, a diſeaſe common in children, eſpecially thoſe who are afflicted with the ſtone, and of not much conſequence; in men it is more rare and dangerous, being generally attended with a flux of humours. I have ſeen caſes related of a prolapſus ani being cured by taking away a piece of the prolapſed gut with a cauſtic, lengthways of the gut; when the wound diſcharged the flux of humours, the gut was eaſily reduced, and cicatrizing in that ſtate, it never more fell down. Another, where a bold unthinking ſurgeon having cut off the prolapſed part, the cicatrix was ſo hard and contracted that the patient could never after go to ſtool without a clyſter, and then not without great miſery. Oftentimes the piles occaſion large tumors at the lower end of this gut; theſe are always beſt extirpated by ligature; for if they are cut, they will ſometimes bleed exceſſively, and it is no eaſy matter to apply any thing to ſtop a flux of blood in that part. The guts have the ſame coats as the ſtomach, and the great guts have three membranes or ligaments, running on the outſide their whole length, and ſupporting the ſacculi into which thoſe guts are divided. The leſſer guts have, at very ſmall diſtances, ſemilunar valves, placed oppoſite to the interſtices of each other, to prevent the aliment from paſſing too ſpeedily thro' the guts; and the better to anſwer that end, they are larger and more numerous near the ſtomach, where the food is thinner,

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than they are towards the colon, where the food is continually made thicker in its progreſs, by a diſcharge of part of the chyle. This contrivance, ſo neceſſary to men becauſe of their erect poſture, when they are obliged by ſickneſs, or accidents, to lie along, becomes a great inconvenience, and calls for the help of clyſters and purges. But brutes have not theſe valves, becauſe they are not convenient in an horizontal poſture. At the entrance of the ilium into the colon, are two very large valves, which effectually hinder the regreſs of the fæces into the ilium. Clyſters, indeed, have been frequently known to paſs them, and be vomited up; but the excrement that is ſometimes vomited up, I am apt to think, is ſuch as had not paſſed into the great guts. The other valves in the colon are placed oppoſite, but not in the ſame place, to each other, and make with their anterior edges an equilateral triangle; but as the gut approaches the anus, they become leſs remarkable, and fewer in number, as before obſerved. All the inteſtines have in their inner membrane an almoſt infinite number of very ſmall glands: beſides the Brunnerian glands of the duodenum (already ſpoken of, there are others named Pyeri, from the diſcoverer. Theſe glands will, eſpecially ſome of them in the large guts, appear to the naked eye when they are diſeaſed. Their office is to diſcharge into the inteſtines a liquor, which ſerves for the attenuation of the chyle, for lubricating the inteſtines; and in the large guts, to ſoften the fæces, that they may be evacuated without pain. The uſe of the ſmaller guts is to promote the formation of the chyle, to perfect its ſecretions, and to propel the remaining fæces to the larger. The office of the larger guts is to receive and collect the matter of the fæces, and at a proper time to expel it. The length of the guts to that of the body is as five to one in a middle ſized man; in taller men the proportion is uſually leſs, and in ſhort men greater. The inteſtines have veſſels in great abundance, running over every part of their ſubſtance. Their arteries are from the meſeraic ones; the upper meſeraic ſerving for the ſmaller inteſtines, the lower for the larger; and theſe make a multitude of very ſingular and ſurprizing anaſtomoſes. The veins are meſeraics, and go off to the vena portæ and the liver. The nerves are ſent from the intercoſtals, and the par vagum. Beſides theſe we are to obſerve the lacteal veſſels deſcribed in Chap. i. Sect. 9. The rectum, it is to be obſerved, receives blood-veſſels alſo from the hypogaſtrics.

Meſentery.

The meſentery is a thick fat membrane, placed in the middle of the abdomen, or midſt of the inteſtines, particularly of the ſmaller ones, whence it is has the name. It is almoſt of a circular figure, with a narrow production, to which the end of the colon and beginning of the rectum are faſtened. It is about four fingers in breadth, and half a hands breadth in diameter; its circumference is full of plaits and foldings, and about three ells in length; the Inteſtines are tied like a border on this circumference, ſo that to every inch of the meſentery, there are about three inches of the inteſtines faſtened. Its ſubſtance is compoſed of membranes, fat, veſſels of all kinds, and a number of glands. Its coats or membranes are two, and between theſe there is a cellular ſubſtance, which contains the fat: the meſeraic veſſels and glands are alſo placed there, which many reckon a third coat of the meſentery, and that not improperly; this they call the tunica celluloſa. In the upper part it is ſtrongly faſtened to the three ſuperior vertebræ of the loins; and in the lower, with the inteſtines, and particularly with the jejunum and ilium. The veſſels of the meſentery are blood-veſſels, nerves, lacteals, and lymphatics. The blood-veſſels are the ſame with thoſe of the inteſtines, and theſe make a multitude of ſtrange meanders, and have very frequent anaſtomoſes. The nerves alſo come from the par vagum, and the intercoſtals. There are a number of glands diſperſed throughout the whole meſentery, from which they take their name: theſe vary greatly in their ſize, figure, and ſituation in different ſubjects, and in old people they frequently almoſt diſappear. The uſes of the meſentery are to preſerve the jejunum and ilium from twiſting in their periſtaltic or vermicular motion, and to confine the reſt to their places; to ſuſtain the ſanguiferous and lacteal veſſels of the inteſtines, and to make the way for the lacteals to the receptacle the ſhorter.

Meſocolon. The meſocolon is that part of the meſentery connected with the great guts, eſpecially the colon. The meſocolon meets the middle of the colon, to which it is joined. Its lower part ſticks to a part of the rectum.

Liver. The liver is the largeſt gland in the body, of a duſky red colour, ſituated immediately under the diaphragm in the right hypochondrium. Its figure is almoſt round, the upper ſurface convex, ſmooth, and equal; the lower, hollow and unequal; backward, toward the ribs it is thick, and thin on its forepart, where it covers the upper ſide of the ſtomach, and ſome of the guts. In its middle and forepart it is divided into two by a fiſſure where the umbilical veſſels enter. It is faſtened in the body by two ligaments; the firſt, which is large and ſtrong, comes from the peritonæum that covers the diaphragm, to which the upper ſide of the liver adheres, and is thus tied to it and the ſternum, being named latum, or ſuſpenſorium: the ſecond is the umbilical vein, which after the birth degenerates into a ligament called teres or umbilicale; it is inſerted at a ſmall fiſſure in the lower edge of the liver. The ligamentum latum vel ſuſpenſorium, ſuſtains the liver in an erect poſture, or rather fixes it in its ſituation, while it is ſupported by the other viſcera, they being compreſſed by the abdominal muſcles. In lying down, the teres prevents it from preſſing on the diaphragm; and in lying on the back, they both together ſuſpend it, that it may not compreſs and obſtruct the aſcending vena cava. The veſſels of the liver are very numerous, receiving arteries from the cœliac and meſenterica ſuperior, called arteriæ hepaticæ; veins from the vena cava, and vena portæ; and nerves, from the plexus hepaticus of the intercoſtals. The biliary veſſels are the ductus choledochus communis, which opens obliquely into the duodenum; the ductus cyſticus, which runs from the gall-bladder to the common duct; the ductus hepaticus, which runs from the liver to the common duct; and the branches of this diſtributed through the liver, make what are called pori biliarii. The liver has alſo a great number of lymphatics, moſt of which open near the vena portæ, or the concave ſide of the liver; from thence the lympha is carried by other lymphatics to the receptaculum chyli. To theſe veſſels we may add the canalis venoſus, and the great ſinus of the vena portæ in the fœtus. The vena cava, and the vena portæ, are accompanied in the liver with many ſmall branches of the cœliac and meſeraic arteries abovementioned.

The vena portæ ſupplies the place of an artery, brings the blood full of bile for ſecretion, which being ſtrained off, the vena cava returns the blood which remains. The vena portæ and the cava, enter the liver by its concave ſide, and are equally diſtributed through all its ſubſtance; wherever there is a branch of the one, there is alſo a branch of the other.

Gall bladder.

The excretory ducts of the liver are the veſicula fellis, and porus biliarius. The veſicula fellis, or gall-bladder is a receptacle of bile, faſtened to the concave part, or under ſide of the liver; its figure is like that of a pear, and in general, of the ſize of a ſmall hen's egg, though it differs in bigneſs in almoſt every perſon. When the liver is in its natural ſituation, the bottom, or largeſt part of the gall-bladder, is downwards, and the neck, or narrow part upwards; and then it touches the ſtomach as well as the colon, where it frequently dyes them yellow. This bladder is compoſed of three membranes, or coats; the outermoſt is common to it with the liver, the next, is muſcular, and the third, is nervous, covered with a kind of cruſt or mucus, which preſerves it againſt the acrimony of the ſecreted bile, probably by ſome ſmall glands, which Malpighi has remarked, between its coats, where the cyſtic arteries end; which gave him ground to think, that it was the ſame in the porus biliarius. The bile is brought into the gall-bladder by ſome ſmall veſſels which ariſe from the neighbouring glands, and which uniting, form one or two pipes, which open at the neck of the bladder. Theſe ducts are hard to diſcover in any liver except that of an ox. From the neck of the gall-bladder there goes a pipe about the bigneſs of a gooſe-quill called ductus cyſticus, running towards the duodenum. Some ſmall biliary ducts open likewiſe into it, and its inner membrane has ſeveral rugæ, which retard the motion of the bile. From the liver to this duct, runs one called hepaticus, which carries off the gall this way, when the gall-bladder is full; theſe two together make the ductus communis choledochus, which go as obliquely to the duodenum and enters that gut about four inches below its beginning. The gall-bladder has two veins from the vena portæ, which are called cyſticæ gemellæ. It has ſome ſmall arteries from the cæliaca dextra, and ſome lymphatics. The uſe of the gall-bladder is to collect the bile, firſt ſecreted in the liver, and mixing it with its own peculiar produce, to perfect it farther, to retain it together a certain time, and then to expel it.

Porus biliarius.

Porus biliarius, according to ſome, is the ſame with the ductus hepaticus; but I ſhall, with many others, make a diſtinction between them, having already obſerved, that the hepatic duct runs from the liver to the ductus choledochus.

The porus biliarius is another excretory veſſel of the liver; it has as many branches as the vena portæ, which it accompanies through every part of the liver. Wherever there is a branch of the one there is a branch of the other; and theſe two are incloſed in one common capſule, as in a ſheath. The uſe of this capſule is to facilitate the motion of the blood and bile, by the contraction of its fibres. All theſe branches unite, and make one trunk, of the bigneſs of a ſmall quill, which joins the end of the cyſtic duct, from carrying the bile from the liver to the inteſtines by the common duct; as was ſaid before. The inſertion of the porus biliarius into the cyſtic duct is oblique, with its mouth looking towards the ductus communis, by which means it is impoſſible that the bile, which comes from the cyſtis, can enter the porus biliarius, unleſs the common duct is ſtopped.

As the liver, from its ſituation in the ſame cavity with the ſtomach, will be moſt preſſed, and conſequently, ſeparate moſt gall when the ſtomach is fulleſt, which is the time when it is moſt wanted; ſo the gall-bladder being ſeated againſt the duodenum, will have its fluid preſſed out by the aliment paſſing thro' that gut, and conſequently, at a right time, and in due proportion; becauſe the greater that quantity of aliment is, the greater will be the compreſſion; and ſo the contrary. There is no way of computing with any exactneſs the quantity of bile that is uſually ſecreted by the liver in a given time; but if it is four times as much as all the ſalivary glands ſecrete, it may be twenty-four ounces for every meal; to which being added ſix ounces of ſaliva, which from what has been formerly obſerved, appears to be a moderate computation; ſuppoſing the pancreas in the ſame time ſecretes three ounces, there will then be thirty-three ounces of fluids ſeparated for the digeſtion of one meal; and that theſe neceſſary fluids may not be waſted in ſuch quantities, they paſs into the blood with the chyle, and may be ſoon ſeparated again for the ſame uſe; and very likely, ſome of the ſame bile may be employed more than once, for digeſting part of the ſame meal. As the liver exceeds all the glands in the body in magnitude, and its excretory ducts ending in the duodenum, it ſeems to me to be much more capable of making thoſe large ſeparations from the blood, which are procured by cathartics, than the ſcarce viſible glands of the guts. The liver ordinarily weighs, in a middle-ſized man, about three pounds twelve ounces: the pancreas, three ounces; and the ſpleen, fourteen ounces.

Pancreas. Pancreas, commonly called the ſweet-bread, is a large gland of the ſalivary kind, lying acroſs the upper and back-part of the abdomen, near the duodenum, behind the ſtomach, and between the liver and ſpleen. Its length is eight or nine inches; its breadth about two fingers, or two and a half; its thickneſs about one finger, and its weight about three ounces, as before obſerved. The ſhape of the pancreas very much reſembles the tongue of a dog; it is broadeſt towards the duodenum, and gradually narrower towards the ſpleen. It is ſurrounded with a membrane, which is continuous with the peritonæum; it has arteries from the cœliac and ſplenic branches, and veins alſo from the ſplenic vein; its nerves are from the par vagum and the intercoſtals; and finally it has a ſhort excretory duct, which is ſituated in the middle of the pancreas, where it reſembles an empty vein, and is about the thickneſs of a very ſmall ſtraw, though it is commonly painted as large as the ductus communis choledocus. This duct terminates in the duodenum, which it enters obliquely, four or five fingers breadth below the pylorus, uſually at the ſame orifice with the ductus choledocus; but ſometimes it has a double aperture. The uſe of the pancreas is to ſecrete a peculiar liquor, called the pancreatic juice, which is of a ſalivoſe nature, and is carried by the pancreatic duct into the duodenum, where it ſerves to dilute the chyle, or render it more fluid and fit to enter the mouths of the lacteals; and, perhaps, to temper and dilute the bile, to change its viſcidity, bitterneſs, colour, &c. and make it mix with the chyle, in order to reduce the ſeveral taſtes, odours, and properties of the ſeveral foods, into one homogeneous one. See Chap. VIII. ſect. 7.

In thoſe who die of the jaundice, for the moſt part are found in the gall-bladder, and the biliary ducts, concretions of bile ſo light as to ſwim in water, yet are called gall-ſtones: theſe cauſe the jaundice, by obſtructing the ducts; many perſons who have been cured of this diſeaſe, have had great numbers of theſe ſtones found in their excrements.

Spleen. The ſpleen is a viſcus of a deep blackiſh-red colour, ſituated on the left ſide of the ſtomach, immediately under the diaphragm, near the ribs and above the left kidney. The figure of it is a ſort of depreſſed oval, near

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twice as long as broad, and almoſt twice as broad as thick. Its uſual ſize is five or ſix inches long, three broad, and one inch thick; but this varies in different ſubjects. Sometimes it is divided into lobules, but for the moſt part, it has only one or two ſmall fiſſures on its edge, and ſometimes none. It is ſupported by the contained parts, and fixed to its place by an adheſion to the peritonæum and diaphragm; it is alſo connected with the ſtomach, by the vaſa brevia, and with the pancreas, omentum, and left kidney, by membranes. The ſubſtance of the ſpleen is vaſcular and fibroſe; and what authors have deſcribed as glands in the ſpleen, Ruyſch has proved to be only veſſels; all the glands about the ſpleen being only one or two lymphatic ones, of about the bigneſs of a bean, ſituated without it, near where the veſſels enter. The veſſels of the ſpleen, conſidering its ſize, are remarkably large: its artery is from the cæliac, and is called the ſplenic artery; the ſplenic vein is, like thoſe of the other viſcera, very much ramified, and its branches are carried throughout the whole ſpleen; the nerves of the ſpleen are from the plexus ſplenicus: the ſpleen has no excretory duct; but there are in it lymphatic veſſels, running to the receptaculum chyli. The uſe of the ſpleen has been much controverted by authors; but the moſt probable opinion ſeems to be, that it ſerves to render the blood more fluid, out of which the bile is to be afterwards ſecreted; and that by this means obſtructions, which muſt otherwiſe be frequent, are prevented, and the ſecretion of the bile promoted.

For a deſcription of the venæ lacteæ, receptaculum chyli, and ductus thoracicus, ſee Chap. i. ſect. 9.

Kidneys. The kidneys are two dark-red viſcera, of an oblong figure, reſembling a large bean; ſituated one on each ſide the vertebræ of the loins, in the poſterior part of the abdomen, upon the two laſt ribs. The right kidney lies under the great lobe of the liver, and is, conſequently, lower than the left, which lies under the ſpleen; the concave ſide of the kidneys is turned inward to the vertebra, and the convex ſide outward. The kidneys are connected with the loins, the lower ribs, the colon, glandulæ renales, renal veſſels, and the ureters. They have two membranes, the one common from the peritonæum, called the adipoſe membrane, from its being generally covered with much fat; this ſurrounds them but looſely and is furniſhed with its own proper veſſels. The other membrane is proper, is very thin, and every where applied cloſely to the ſubſtance of the kidneys. The ſubſtance of the kidneys is firm and hard, and is of two kinds. The exterior, or cortical, according to Malpighi, is glandular, but according to the diſcoveries of Ruyſch, is throughout elegantly vaſcular. The interior is tubulous, and expreſſed by the name of tubuli urinarii bellini; theſe terminate in ten or twelve papillæ, which open by a multitude of apertures into the pelvis; but theſe papillæ are not found in all ſubjects. Their length anſwers to the diſtance between the two laſt falſe ribs and the os ilium, which is generally about five or ſix fingers breadth; they are about half as broad as long, and half as thick as broad. The veſſels of the kidneys are, like thoſe of the liver, included in a membrane, from the peritonæum. The arteries and veins are large, and called emulgents, and renal veſſels; theſe are produced from the aorta and vena cava: the nerves are from the plexus renalis proceeding from the intercoſtals. There is alſo a number of lymphatics, paſſing to the receptaculum chyli; and alſo an excretory duct, called the ureter, below deſcribed.

The uſe of the kidneys is to ſecrete the urine from the blood, which is brought there for that purpoſe by the emulgent arteries; and what remains from the ſecretion, is returned by the emulgent veins, while the urine ſecreted is carried off through the ureters to the bladder.

Glandulæ renales.

Glandulæ renales, called alſo capſulæ atrabiliariæ, and renes ſuccenturiati, are two yellowiſh glands of a compreſſed figure, lying on each ſide of the upper part of the kidneys, a little above the emulgent veſſels. They have a very narrow cavity, imbued with a browniſh liquor of a ſweetiſh taſte. Their figure is irregular, between ſquare, triangular, and oval; and their ſize alſo is various; but in adults, they are generally about the bigneſs of a large nux vomica. In the fœtus, they are larger, and often exceed the kidneys themſelves in ſize. The membrane that ſurrounds them is very thin; it cloſely involves their whole ſubſtance, and connects them with the kidneys. Their blood-veſſels are ſometimes ſent from the aorta and the vena cava, but more frequently from the emulgents: their nerves ate from the plexus renalis; and their lymphatic veſſels are numerous. There is no excretory duct diſcovered in them, and their uſe is therefore not certainly known. By their great ſize in the fœtus, they ſeem deſtined rather to the ſervice of that ſtate, than of any other.

Ureters. The ureters are tubes about the bigneſs of gooſe quills, and about a foot long; they ariſe from the hollow ſide of the kidneys and terminate in the urinary bladder near its neck. At their origin in the kidneys they are expanded into the form of a funnel, and this expanſion makes the pelvis of the kidneys: at their termination in the bladder they paſs obliquely for the ſpace of an inch in between its coats; which manner of entering is to them as valves; for their orifices being narrow will admit of nothing into them from the bladder. The ureters are not ſtreight, but ſomewhat bent, ſo as to reſemble the letter S. Their ſubſtance is membranous, and they are compoſed of three coats; the firſt is from the peritonæum; the ſecond is a thin muſcular one; and the third a nervous one, covered with a ſlimy liquor to defend it againſt the acrimony of the urine; and in this, there are ſometimes diſcovered glands. The blood-veſſels and nerves come from the adjacent parts. Such as are ſubject to the gravel, and given to exceſs of drinking, have them ſometimes ſo much dilated, that you may put the end of the little finger into them. Their uſe is to carry the urine from the kidneys to the bladder. Their obſtruction cauſes a ſuppreſſion of urine.

Bladder. The urinary bladder is ſeated in a duplicature of the peritonæum in the lower part of the pelvis; its ſhape is orbicular, and its coats are the ſame with thoſe of the guts already deſcribed; viz. an external membranous,

nous, a middle muſcular, (which is the detruſor urinæ), and an inner membranous or nervous coat; which is covered with a peculiar fluid of a mucous nature, ſecreted in glands ſituated in this coat, and principally in that part which is near the neck of the bladder. The coats of the bladder are much thinner in the body and the fundus (which is the bottom, ſituated uppermoſt) than they are at the neck and loweſt part. The ſphincter, in the neck of the bladder, cloſes it, to prevent an involuntary diſcharge of urine. The bladder in adults will conveniently hold about a pint; but it is capable of diſtenſion ſo as to hold much more It is connected, in the human body, in a ſingular manner, by the peritonæum to the os pubis, otherwiſe than in other animals: it is alſo connected with the parts of generation by the urethra; with the navel by the urachus and umbilical arteries; and finally, in men, with the inteſtinum rectum; and in women, with the vagina. The blood-veſſels of the bladder come from the hypogaſtric, the umbilical, and the hæmorrhoidal veſſels in men; and in women, from the ſpermatics alſo. Its nerves are from the intercoſtals, and principally from thoſe of the os ſacrum. The bladder has three foramina; two where the ureters enter in, at which the urine paſſes into the bladder; and one, much larger than theſe, in the neck, for the diſcharge of the urine into the urethra. The nervous or inner coat of the bladder is exceeding ſenſible, as is fully ſhewn in the caſes of the ſtone and gravel.

For a deſcription of the urethra, internal and external parts of generation in both ſexes, ſee Chap. viii. Sect. 2.

SECT. VI.

Of the ARTERIES, VEINS, NERVES, and GLANDS of the ABDOMEN.

Arteries of the abdomen.

THE arteries of the abdomen are various, and proceed from the aorta, already deſcribed. They take their names from the parts they are beſtowed on; the principal are, arteriæ diaphragmaticæ, arteria cæliaca, ventriculi, coronaria, hepatica, ſplenica, meſenterica ſuperior et inferior, arteriæ renales, capſulares, ſpermaticæ, lumbares, ſacræ, iliacæ and crurales.

Arteriæ diaphragmaticæ vel phrenicæ.

Arteriæ diaphragmaticæ, called alſo phrenicæ, ariſe from the aorta as it paſſes under the diaphragm, generally in two branches, which are ramified on the diaphragm; but it ſometimes riſes in one trunk from the aorta, and ſometimes from the cœliaca; though oftener the right from the aorta, and the left from the cœliac. They give ſmall branches to the glandulæ renales and membrana adipoſa of the kidneys, the latter being called arteriæ adipoſæ. Beſides theſe capital diaphragmatic arteries, there are others of an inferior claſs, which come from the intercoſtals, mammariæ internæ, mediaſtinæ, pericardiæ, and cœliaca, as is obſerved in the deſcription of each of theſe arteries.

Arteria cœliaca.

Arteria cœliaca ariſes from the aorta deſcendens, immediately below the diaphragm. It ſoon divides into ſeveral branches, which are beſtowed upon the liver, pancreas, ſpleen, ſtomach, omentum, and duodenum. Theſe branches are named from the parts they are be-

beſtowed on, except the ventriculi coronaria beſtowed upon the ſtomach, and the branch beſtowed upon the duodenum, which is named inteſtinalis. The principal branches are the following:

Arteria ventriculi coronaria. Arteria ventriculi coronaria is ramified on every part of the ſtomach, and ſends off ſmall branches to the ſmall lobe of the liver and the neighbouring parts of the diaphragm and omentum.

Arteria hepatica. Arteria hepatica ariſes alſo from the cœliaca; it runs to the upper and inner part of the pylorus in company with the vena portæ, ſending off a ſmall branch called arteria pylorica, and a large one named gaſtrica dextra or major.

Pylorica. The pylorica is ramified on the pylorus and neighbouring parts of the ſtomach, and communicates with the right gaſtric and coronary artery.

Gaſtrica. The gaſtrica dextra, having paſſed behind and beyond the pylorus, ſends off a conſiderable branch named arteria duodenalis or inteſtinalis, which ſometimes comes from the hepatica as below; after this, the gaſtric runs along the right ſide of the great curvature of the ſtomach, diſtributing branches to the neighbouring parts on both ſides, which communicate with thoſe of the pylorica, coronaria ventriculi, and gaſtro-epiploicæ dextra, the latter furniſhing the neareſt parts of the omentum and communicating with the meſenterica ſuperior. At laſt, the right gaſtric ends in the left, which is a branch of the ſplenica.

Inteſtinalis. The duodenal or inteſtinal artery runs along the duodenum on the ſide next the pancreas; to both which it ſends branches, and alſo to the neighbouring part of the ſtomach. The hepatic artery having ſent out the pylorica and gaſtrica dextra, gives two branches to the veſicula fellis called arteria cyſticæ, and another named bilaria, which is loſt in the great lobe of the liver. Afterwards, the hepatic artery is ramified with the vena portæ through all the ſubſtance of the liver; having firſt ſupplied the capſula communis vel Gliſſoni, as it paſſes; (this capſula, called Gliſſoni from its diſcoverer, is a tunic continuous with the peritonæum, and includes the branches of the vena portæ and biliary ducts as they approach the liver, as well as within it.)

Cyſticæ et bilaria.

Arteria ſplenica.

Arteria ſplenica ariſes cloſe by the hepatica, the hepatic branch going to the right, and the ſplenic to the left; immediately after its origin from the cœliaca it runs toward the left under the ſtomach and pancreas to the ſpleen. It gives ſeveral branches to the pancreas named arteriæ pancreaticæ. Under the left portion of the ſtomach it gives off a branch called gaſtrica ſiniſtra, to the left ſide of the ſtomach, which communicates with thoſe of the coronaria ventriculi. This gaſtric artery alſo ſupplies the omentum with branches, termed gaſtro-epiploicæ ſiniſtræ, which communicate with the right gaſtric. By this account, it appears that the arteria coronaria ventriculi, pylorica, inteſtinalis, both gaſtricæ, gaſtro-epiploicæ, and conſequently the hepatica, ſplenica, and meſenterica, communicate all together. After this, before the ſplenica arrives at the ſpleen, it gives two or three branches to the large extremity of the ſtomach, commonly

Pancreaticæ.

Vaſa brevia, &c.

monly called vaſa brevia; and one to the omentum, named epiloica.

Arteria meſenterica ſuperior.

Arteria meſenterica ſuperior ariſes anteriorly a very little way below the cœliaca, going out a little to the right and then immediately turning to the left. Near its origin it gives off a ſmall branch, which dividing into two, goes to part of the pancreas and neighbouring part of the duodenum, communicating with the inteſtinalis. Afterwards, it goes between the laminæ of the meſentery, and the duodenum and meſaraic vein, and diſtributes a number of branches to the ſmall inteſtines, from the lower third part of the duodenum, to the cæcum and colon. As they approach the inteſtines, all theſe branches communicate firſt by reciprocal arches; then by areolæ and meſhes of all kinds of figures, from which is detached an infinite number of ſmall ramifications, which ſurround the inteſtinal canal like an annular piece of net-work.

Arteria meſenterica inferior.

Arteria meſenterica inferior ariſes anteriorly from the aorta deſcendens inferior, about an inch above the bifurcation, and below the ſpermatic arteries; ſoon after it divides into three or four branches which gradually ſeparate from each other, and are diſtributed to the colon and rectum, communicating with one another. One conſiderable branch of theſe is called arteria hæmorrhoidalis interna, which runs down behind the inteſtinum rectum, to which it is diſtributed by ſeveral ramifications, and communicates with the arteriæ hypogaſtricæ.

Hæmorrhoidalis interna.

Arteriæ renales.

The renal arteries, commonly called emulgents, are ordinarily two in number, and go out laterally from the inferior deſcending aorta, immediately under the meſenterica ſuperior, one to the right hand, the other to the left. They enter into the depreſſions of the kidneys by ſeveral branches, which form arches in the inner ſubſtance of theſe viſcera; from theſe arches numerous ramifications go toward the outer ſurface of the kidneys. Sometimes the renal arteries ſend branches to the glandulæ renales, membrana adipoſa of the kidneys, and even to the diaphragm.

Arteriæ capſulares.

Arteriæ capſulares are the arteries of the renal glands, which ariſe ſometimes from the aorta, ſometimes from the trunk of the cœliaca; but generally the right comes from the arteria renalis of the ſame ſide, near the origin; the left, from the aorta above the renalis.

Arteriæ ſpermaticæ.

Arteriæ ſpermaticæ are commonly two in number, ſometimes more; they are very ſmall, and go out anteriorly from the aorta deſcendens inferior, near each other, about an inch below the renales, between the two meſentericæ, or between the renales and meſentericæ inferiores. They ſend off ſmall branches to the common membrane of the kidneys, named adipoſæ, and afterwards they run down upon the pſoas muſcles, on the fore-ſide the ureters, between the two laminæ of the peritonæum. They give ſeveral conſiderable branches to the peritonæum, chiefly to thoſe parts of it which are next the meſentery, and they communicate both with the meſentericæ and adipoſæ. They likewiſe ſend ſmall arteries to the ureters. Afterwards, they paſs in men through the tendinous openings of rings of the abdominal muſcles in the vagina of the peritonæum, (termed proceſſus vaginalis) and are diſtributed to the teſticles and epididymes, where they communicate with a branch of the iliaca externa. In women they do not go out of the abdomen, but are diſtributed to the ovaria and uterus, and communicate with branches of the hypogaſtrica, at the jagged extremities of the tubæ Fallopianæ.

Arteriæ lumbares.

The lumbar arteries go out poſteriorly from the inferior deſcending aorta, in five or ſix pairs, or more, much in the ſame manner with the intercoſtals. They may be divided into ſuperior and inferior: the ſuperior ſend ſmall branches to the neighbouring parts of the diaphragm and intercoſtal muſcles, and ſupply the place of ſemi-intercoſtal arteries. Sometimes thoſe pairs go out by a ſmall common trunk, and not ſeparately. They are diſtributed on each ſide to the pſoas muſcles, to the quadrati lumborum, and to the oblique and tranſverſe muſcles of the abdomen; and by perforating the oblique muſcles, they become external hypogaſtric arteries. They go likewiſe to the vertebral muſcles and bodies of the vertebræ; and enter the ſpinal canal through the lateral notches, to go to the membranes, &c. forming rings much in the ſame manner with the intercoſtals; and they likewiſe give ſmall twigs to the nerves.

Arteriæ ſacræ.

Arteriæ ſacræ are generally two, three, or four in number, and ſometimes but one. They go out commonly from the back-part of the inferior deſcending aorta at the bifurcation. Sometimes they ariſe higher, from the lumbares, and ſometimes lower, from the iliacæ. Theſe arteries are ramified on the os ſacrum, and neighbouring parts of the peritonæum, inteſtinum rectum, fat, &c. and enter the canal of that bone through the anterior holes, being there diſtributed toward each ſide. They likewiſe ſend ſmall arteries to the large faſciculi of nerves, which go through the holes of the os ſacrum, and they penetrate the inner ſubſtance of that bone.

Arteriæ iliacæ. Arteriæ iliacæ are thoſe two large lateral branches ariſing at the bifurcation, where the aorta deſcendens inferior ends at the laſt vertebra of the loins, and ſometimes higher. One branch goes to the right hand, the other to the left, and each is a common trunk. The primitive iliac arteries divaricate gradually as they deſcend, running obliquely toward the anterior and lower part of the oſſa ilium, without any conſiderable ramification for about the breadth of three fingers, except a few very ſmall arteries that go to the os ſacrum and neighbouring muſcles, &c. They likewiſe give ſmall arteries to the peritonæum, coats of the veins, fat and ureters, behind which the iliac trunks paſs. About three fingers breadth from their origin, each iliac trunk is divided into two ſecondary arteries, one external, the other internal; the former has no particular name, but the latter is termed hypogaſtrica.

Iliaca externa. The external iliaca on each ſide runs down on the iliac muſcle to the ligamentum Fallopii, under which it goes out of the abdomen, and as it paſſes under this ligament, it detaches two conſiderable branches, one internal, the other external. The internal branch is named arteria epigaſtrica, and goes out anteriorly from the external iliaca. From thence it runs obliquely upward on the tendon of the tranſverſe muſcles toward the poſterior part of the rectus, which it reaches about two or three fingers breadth above the os pubis, and runs up along the poſterior or inner ſide of that muſcle, ſending ramifications to the tendons of the neighbouring muſcles, &c. after which it communicates with the mammaria interna and intercoſtalis inferior; it ſometimes gives out two particular branches, one of which, accompanied by a nerve, goes through the foramen ovale of the pelvis to the triceps muſcles, &c. the other runs down to the teſticles along with the ſpermatic artery, and there communicates with it. The external branch of the outer iliaca goes off laterally from the outſide of that artery under the ligamentum Fallopii, and from thence to the internal labium of the os ilium, where it divides into two, and is ramified on the oblique and tranſverſe muſcles of the abdomen, communicating with the arteria lumbares. Beſides theſe, a ſmall twig goes off internally to the vagina of the ſpermatic rope, and ſometimes another from the outſide to the os ilium.

Iliaca interna vel hypogaſtrica.

The internal iliaca, or hypogaſtrica, having run about an inch and a half inward and backward, bends by ſmall degrees obliquely forward, and toward the outſide, ending in the umbilical artery, which ought to be looked upon as a true continuation of the trunk of the hypogaſtrica. This arteria umbilicalis aſcends on the ſide of the bladder, and being ramified on that viſcus, and the neighbouring parts of the peritonæum, &c. it contracts, and in adults is quite cloſed up above the middle of the bladder: it like-

Umbilicalis.

likewiſe gives branches to the uterus, and to the neighbouring parts in both ſexes. Afterwards it aſcends in form of a ligament to the umbilicus, where it joins that on the other ſide; its name being taken from its uſe in the fœtus. From the convex ſide of the curvature of the hypogaſtrica ariſe the following branches, viz iliaca minor, glutæa, ſciatica, pudicæ, and obturatix.

Iliaca minor.

Iliaca minor is the moſt poſterior of theſe branches, and paſſing between the two lumbar nerves, divides into two; one branch going to the canal of the os ſacrum, the other to the iliac muſcle, and inſide of the os ilium, giving twigs as it paſſes to the pſoas muſcle.

Glutæa.

The arteria glutæa is commonly very conſiderable, and ſometimes the largeſt of all the hypogaſtric branches: this artery goes out of the pelvis in company with the ſciatic nerve, through the upper part of the great ſinus of the os innominatum, below the muſculus pyramidalis, and is diſtributed to the glutæus maximus and medius. In its paſſage, it gives ſome branches to the os ſacrum, os coccygis, muſculus pyramidalis, muſcles of the anus, and to the neighbouring parts of the inteſtinum rectum, forming a particular hæmorrhoidalis interna. It likewiſe ſends twigs to the bladder and parts near it; and detaches a pretty long branch which runs down with the ſciatic nerve.

Sciatica.

The arteria ſciatica gives firſt of all ſome branches to the muſculus pyramidalis, quadrigemini, os ſacrum, &c. and even to the inner ſide of the os iſchium; and a branch runs under the quadratus to the articulation of the os femoris. It detaches ſmall branches to the ſciatica nerve, and is then diſtributed to the inner ſubſtance of the os ilium, and to the muſculi glutæi.

The pudica communis, called commonly pudica interna, gives out two principal branches; the firſt paſſes through the great ſinus of the os ilium with the glutæa and ſciatica, and then divides into two; the firſt branch goes behind the ſpine of the iſchium all the way to the origin of the corpus cavernoſum penis. There it divides into ſeveral arteries; one goes to the ſphincter ani, named hæmorrhoidalis externa. The reſt are diſtributed to the neighbouring integuments, to the bulb of the urethra, and to the corpus cavernoſum penis; but the laſt of theſe arteries, or rather the extremity of it, runs from behind forward, over the neck of the os femoris and communicates with a branch of the crural artery. The ſecond principal branch, commonly called pudica externa, runs between the bladder and inteſtinum rectum, and is diſtributed in men, to the veſiculæ ſeminales, neck of the bladder, proſtatæ, and neighbouring parts of the rectum. It then runs under the os pubis on the ſide of a conſiderable vein; and along the penis between this vein and a nerve, being diſtributed in its paſſage to the corpus cavernoſum, communicates with the pudica minor, which comes from the cruralis. This ſecond branch of the pudica major goes off ſometimes ſeparately from the hypogaſtrica, eſpecially in women, being diſtributed to the uterus, where it communicates with the ſpermatic artery, near the jagged extremity of the tuba Fallopiana; and to the neighbouring parts of the vagina, &c. Pudicæ.

The

Obturatrix. The arteria obturatrix perforates the obturator muſcles, from whence its name, and goes out of the pelvis at the upper part of the ligament of the foramen ovale, having firſt ſent a ſmall branch to the inguinal glands and integuments. As it paſſes by the muſcles, it divides, and is diſtributed to the pectineus and triceps, and another branch, communicates with the ſciatica which goes to the articulation of the os femoris; and gives ſmall arteries to the holes in the neck of that bone. Afterwards the hypogaſtric artery ends in the umbilicalis, as has been already ſaid.

Veins of the abdomen. In deſcribing the veins, I begin by the great trunks, and end by the ramifications in the method before obſerved. The veins of the abdomen are numerous, and all proceed from the vena cava (the vena porta excepted) and chiefly from the vena cava inferior, which trunk, having run down about a quarter of an inch from the right auricle of the heart, within the pericardium, as has been already ſaid, pierces that membrane, and the tendinous portion of the diaphragm, which adhere very cloſely to each other; at this place, it gives off the venæ diaphragmaticæ or phrenicæ.

Venæ diaphragmaticæ vel phrenicæ. Venæ diaphragmaticæ or phrenicæ ariſe from the vena cava inferior, where they pierce the midriff, are diſtributed to the diaphragm; appearing chiefly on its lower ſide, one to the right hand, the other to the left. The left goes partly to the pericardium and partly to the diaphragm; and ſometimes they ſend branches to the capſulæ renales, much in the ſame manner as the arteriæ phrenicæ.

The

Venæ hepaticæ.

The vena portæ is a large vein, the trunk ſituated chiefly between the eminences on the lower or concave ſide of the liver. It may be conſidered as made up of two large veins, joined almoſt endways by their trunks, from each of which the branches and ramifications go to the right and left; but firſt of all the trunk ſends off the venæ cyſticæ gemellæ, gaſtrica dextra, pylorica, ventriculi coronaria, duodenalis or inteſtinalis. The firſt portion of this trunk, known by the general name above mentioned, is already ſpoken of. The other portion is what I am now to deſcribe, with the veins above mentioned from the common trunk. Some authors divide this portion into three principal branches, but as the hæmorrhoidalis interna comes frequently from the meſaraica or ſplenica, or from the angle of the bifurcation, I ſhall confine myſelf to two only, deſcribing it with the meſaraica or right branch.

Cyſticæ gemellæ.

The venæ cyſticæ gemellæ run along the veſicula fellis from its neck to the bottom; they go out from the right ſide of the great trunk near its beginning, ſometimes ſeparately, ſometimes by a ſmall and very ſhort common trunk.

Pylorica.

The pylorica ariſes from the great trunk, almoſt oppoſite to the origin of the cyſticæ, and ſometimes is only a branch of the right gaſtrica. It paſſes over the pylorus to the ſhort arch of the ſtomach, where it is joined by anaſtomoſis with the coronaria ventriculi, gáſtrica dextra or gaſtro-epiploica dextra, going from the pylorus to the great curvature of the ſtomach, and communicating with the gaſtrica ſiniſtra. In its paſſage it ſupplies the ſtomach and omentum, and communi-

Gaſtrica dextra.

municates with the pylorica, coronaria ventriculi, &c. as has been already ſaid.

Coronaria ventriculi.

Coronaria ventriculi, ſo called becauſe it ſurrounds more or leſs the upper orifice of the ſtomach, runs along the ſmall arch of that viſcus towards the pylorus, where it communicates with the pylorica. In its paſſage it gives ſeveral branches to the ſides of the ſtomach, which there form numerous areolæ, and communicate with the veins of the great arch.

Duodenalis vel inteſtinalis.

Duodenalis, or inteſtinalis, goes out from the great trunk near the cyſticæ gemellæ. It is diſtributed chiefly to the inteſtinum duodenum, but ſends ſome branches to the pancreas.

Vena meſaraica.

Vena meſaraica ariſes from the trunk of the portæ near the pancreas, and turns to the right hand; it accompanies the ſuperior meſenteric artery to thoſe portions of the meſentery and meſocolon which belong to the ſmall inteſtines, the cæcum, and right portion of the colon. One branch of the meſaraica runs directly to the middle of the colon, where it is arched to the right and left. A little under this branch ariſes another, which is ſoon divided into two branches, one ſuperior, the other inferior. The ſuperior ſends ſmall veins to the head of the pancreas and the neighbouring parts: the inferior goes to the right portion and upper part of the colon, where it is arched, and communicates with the ſuperior branch, and with one of the vena cæcalis.

Epiploica dextra.

The trunk of the meſaraic ſends out ſometimes a particular branch to the omentum, called epiploica dextra. But almoſt immediately before it aſcends over the meſenteric ar-

artery, it ſends two large branches to the jejunum and part of the ilium, which are diſtributed on thoſe inteſtines by numerous ramifications, which form arches and areolæ like thoſe of the artery; afterwards it paſſes over the artery, to which it adheres very cloſely, ſending out branches almoſt in the ſame manner.

Cæcalis. From the concave ſide of the meſaraiac vein, a little below the origin of the ſecond branch from the convex ſide, ariſes a branch called by Riolan vena cæcalis, which runs to the beginning of the colon. This cæcal vein divides by two arches, the uppermoſt of which communicates with the lower branch of the ſuperior meſaraiac; the other, after having ſent ramifications to the inteſtinum cæcum and appendicula vermiformis, communicates below with the extremity of the meſaraiac.

Hæmorrhoidalis interna. Vena hæmorrhoidalis interna ariſes from the beginning of the meſaraiaca, ſometimes from the ſplenica, and ſometimes between both, at the bifurcation. Near its beginning it gives to the duodenum a ſecond vena duodenalis, which is ſometimes more conſiderable than the firſt before mentioned; it then divides into two branches, the ſuperior runs to the upper part of the arch of the colon, where, after many ramifications, it communicates with the meſaraica, gaſtro-epiploica ſiniſtra, and epiploica. The inferior branch runs down on the left and lower part of the colon, and on the rectum all the way to the anus. In this courſe it ſupplies the meſocolon, and forms arches which ſend out numerous ſmall ramifications round theſe inteſtines. It ſeems likewiſe to communicate, by ſome capillary twigs, with the left ſpermatic vein. This vein is named from the hæmorrhoidal tumors found often at its extremity next the anus.

Vena ſplenica. The ſplenic vein is one of the great branches of the portæ, and turns to the left hand, where the meſaraica does to the right. It runs tranſverſely from the right to the left, juſt under the duodenum, and then along the lower ſide of the pancreas, near the poſterior edge. In this courſe it gives off ſeveral veins, viz. the vena pancreaticæ, gaſtrica ſiniſtra, or gaſtro-epiploica ſiniſtra, and epiploica ſiniſtra. It terminates afterwards by a winding courſe, being divided into ſeveral branches that go to the ſpleen; one of which produces the ſmall veins called by the ancients vaſa brevia.

Pancreaticæ. The venæ pancreaticæ are ſeveral ſmall branches ſent by the ſplenica to the pancreas, along its lower ſide: there are other ſmall pancreatic veins, which do not ariſe from the ſplenica, already ſpoken of.

Gaſtrica ſiniſtra. The gaſtrica ſiniſtra, or gaſtro-epiploica ſiniſtra, goes out from the ſplenica at the left extremity of the pancreas; from whence it runs to the great extremity of the ſtomach, and communicates with the gaſtrica dextra and coronaria ventriculi, giving off ſeveral branches to the ſtomach in its paſſage. At a ſmall diſtance from its origin this gaſtric vein ſends out a branch, which is diſtributed to the omentum, from whence the name of gaſtro-epiploica.

Gaſtro-epiploica and epiploica ſiniſtra. The vena epiploica ſiniſtra ariſes at the ſmall extremity of the pancreas, and is ramified on the omentum all the way to the colon, where it communicates with the hæmorrmorrhoidalis interna. Laſtly, the vena ſplenica reaches the fiſſure of the ſpleen, which it enters, and ſupplies almoſt in the ſame manner as the ſplenic artery.

Vaſa brevia.

From the poſterior of theſe branches, the veins are ſent off to the great extremity of the ſtomach, formerly known by the name of vaſa brevia, which communicate with the coronaria ventriculi and gaſtrica ſiniſtra.

Venæ renales.

The vena cava inferior having got as low as the arteriæ renales, gives off the veins of the ſame name, termed formerly venæ emulgentes, and which are the largeſt of all the veins that go from the cava inferior, from the liver to the bifurcation. The right renal vein is the ſhorteſt; the left croſſes on the fore ſide of the trunk of the aorta, immediately above the ſuperior meſenteric artery, and both veins accompany the renal arteries. They ſend up the venæ capſulares to the glandulæ renales, and downward the venæ adipoſæ, which go to the fatty covering of the kidneys; and ordinarily the left renal vein furniſhes the left ſpermatic vein. Afterwards they run to the cavity of the kidneys, in the ſubſtance of which they are diſtributed by numerous ramifications.

Capſulares et adipoſæ.

Venæ ſpermatic

The right vena ſpermatica comes from the trunk of the cava inferior, a little below the venæ renales, and ariſes anteriorly toward the right ſide. The left ſpermatic vein comes commonly, though not always, from the left renalis, as has been already obſerved; both veins accompany the ſpermatic arteries to the parts hereafter mentioned. In their paſſage, they ſend ſeveral ſmall branches on each ſide to the peritonæum and meſentery, where they are joined by anaſtamoſes with the venæ meſaraicæ and hepaticæ; ſometimes a conſiderable branch is ramified on the iliac muſcle and membrana adipoſa of the kidneys.

Venæ lumbares.

The cava inferior ſends off poſteriorly the venæ lumbares, which commonly ariſe in pairs in the ſame manner as the arteriæ lumbares. Their origins vary in different manners. Sometimes they proceed from a branch on each ſide below the firſt vertebra of the loins. Sometimes, from a branch near the bifurcation of the cava inferior; ſometimes from a branch in the beginning of the left iliac; or from the vena azygos. They all communicate with one another, and ſometimes with the intercoſtals; and alſo the veins of one ſide with thoſe of the other by tranſverſe branches. The lumbar veins ſend ſmall capillaries in their paſſage to the ſubſtance of the bodies of the vertebræ; and they are diſtributed to the muſcles of the abdomen, quadratus lumborum, pſoas, iliacus, &c. They ſend branches backward to the neighbouring vertebral muſcles, and to the canal of the ſpine, and communicate with the venal ſinuſes in the ſame manner as the intercoſtals.

Bifurcatio ex vena cava.

The vena cava inferior, having reached as low as the laſt vertebra of the loins, and near the bifurcation of the aorta, runs in behind the iliac artery, and is there divided into two ſubaltern trunks, called the right and left iliac veins, which lie on the inſide of the iliac arteries.

Vena ſacra.

From this bifurcation of the vena cava, and often from the origin of the left iliaca, the vena ſacra goes out and accompanies the artery of the ſame name in its diſtribution to the os ſacrum, to the nerves which lie there, and to the membranes which cover both ſides of that bone.

Venæ iliacæ. Each original iliac vein is divided on the ſide of the os ſacrum, much in the ſame manner as the arteries, into two large trunks or ſecondary iliac veins. This ſecond bifurcation is about a finger's breadth below that of the iliac arteries. One of theſe trunks is named vena iliaca externa, or anterior, the other interna, or poſterior. The external vein is likewiſe named ſimply iliaca, and the internal, hypogaſtrica. Theſe veins follow nearly the courſe and diſtribution of the iliac arteries, only the hypogaſtric does not ſend off the vena umbilicalis. Near this ſecond bifurcation a particular branch goes out, which is diſtributed to the muſculus pſoas, iliacus, and quadratus lumborum, and a branch of it to the laſt tranſverſe apophyſis of the loins to communicate with the laſt lumbar vein.

Vena iliaca externa. The iliaca externa, a little before it leaves the abdomen, near the ligamentum Fallopii, lying on the pſoas and iliac muſcles, gives off almoſt the ſame branches with the artery of the ſame name, and follows the ſame courſe.

Epigaſtrica. In particular, from the inſide, before it leaves the abdomen, it ſends off the vena epigaſtrica, which is ramified on the neighbouring conglobate glands and abdominal muſcles, penetrating from within outwards: it then runs upward and joins the ramifications of the mammaria, accompanying the epigaſtric artery. From the inſide of the epigaſtric vein, a branch is ſometimes detached to the muſculus obturator internus, where it joins another branch named vena obturatix. Before the iliac vein gets from under the ligamentum Fallopii, it ſends ſeveral ſmall branches to the neighbouring lymphatic glands, and immediately afterwards takes the name of cruralis.

Vena hypogaſtrica vel iliaca interna. The vena hypogaſtrica, or internal iliac vein, runs behind the artery of the ſame name, making the ſame kind of arch, from which branches go out to the cavity of the os ſacrum through the firſt and ſecond great hole of the os ſacrum, to the muſculus ſacer, and other neighbouring muſcles. A large branch runs behind the great ſciatic ſinus to the muſculi glutæi, pyramidalis and gemelli. Another large branch reaching the foramen ovale of the os innominatum, perforates the obturator muſcles, from whence Obturatrix. it is called vena obturatrix, and is diſtributed to the muſculus pectinæus, triceps, and neighbouring parts, communicating with the cruralis. One branch of the obturatix, before it perforates the muſcles, runs towards the ſciatic ſinus, to the muſculus iliacus, the os ilium, and part of the obturator internus. Another branch of the obturatrix is diſtributed to the ureters, bladder, and internal parts of generation in both ſexes. It communicates with the ſpermatic veins, and is more conſiderable in women than in men. Laſtly, the hypogaſtric vein runs backward, and as it goes out of the pelvis it is ramified chiefly upward end downward. It ſends a large branch upward to the lower part of the os ſacrum, and two or more downward, which running behind the ſame ligament over which the hypogaſtric paſſes, and going out of the pelvis, are diſtributed to the buttocks, anus, part of the muſculus pectinæus, and to the external parts of generation, nearly in the ſame manner with the artery which accompanies them.

Hæmorrhoidales externæ.

The veins that go to the anus are termed hæmorrhoidales externæ, and they that go to the parts of generation, pudicæ internæ. The external hæmorrhoidales communicate with the internal veins of the ſame name, which come from the vena meſaraica.

Nerves of the abdomen.

The five pair of lumbar nerves alſo communicate and give poſterior branches: the firſt ſends ſeveral branches to the abdominal muſcles, pſoas, and iliacus, while others go from it to the teguments and muſcles on the ſuperior and anterior part of the thigh, and the main trunk of it is loſt in the crural. The ſecond paſſes through the pſoas muſcle, and is diſtributed much as the former. The third is loſt in the muſculus pectinæus. Branches proceeding from the firſt, ſecond, and third, make up one trunk, which runs along the anterior part of the pelvis, and ſlipping through a ſmall ſinuoſity in the anterior part of the foramen magnum oſſis iſchii, is ſpent in the muſculus triceps. This nerve is commonly known by the name of obturator, or poſterior crural nerve. By the union of branches, from the firſt, ſecond, third, and fourth lumbar nerves, the anterior crural nerve is formed. The remainder of the fourth and fifth lumbar nerves join with the firſt, ſecond, and third, that proceed from the os ſacrum (which are five or ſix pair). Theſe two laſt of the lumbar and three firſt of the ſacrum, when united, conſtitute the largeſt nerve in the body, ſo well known by the name of the ſciatic or iſchiatic nerve. The other nerves that come out of the os ſacrum, are ſent to the organs of generation, muſculi levatores ani, obturatores and adjacent parts.

Glands of the abdomen.

In the abdomen there are a very conſiderable number of glands: the largeſt of them is the pancreas; after this in ſize come the glandulæ renales, or capſulæ atrabiliariæ; after theſe the meſaraics, and the inteſtinals of Brunner and Pyer in the inteſtines; all which have been already ſpoken of in their proper places. The glands of the ſtomach are very eaſily diſtinguiſhable in dogs and hogs, but in human ſubjects it is difficult to find them: many anatomiſts have queſtioned their exiſtence. Morgagni, however, diſcovered them ſo fairly in human ſubjects, that there is no doubt left about them. About the vertebra of the loins, near where the receptaculum chyli is ſituated, and above the os ſacrum, and the diviſions of the iliac veſſels, are many glands of various ſizes and figures: they are commonly called lumbares, ſacræ, and iliacæ, and they have numerous lymphatics entering into them, and diſcharging their contents into the receptaculum chyli. The lumbar glands have been ſometimes found ſwelled to the bigneſs of a man's fiſt. In the concave part of the liver, about the ingreſs of the vena portæ and the neck of the gall-bladder, as alſo about the ſpleen, near the ingreſs of the veſſels, there are frequently found conglobate glands, of about the bigneſs of a kidney-bean: theſe are called by authors hepatic glands, cyſtic glands, or have other names derived from the adjacent parts; and they ſeem to ſerve the lymphatic veſſels. About the left orifice of the ſtomach,

mach, there ſometimes alſo is found, according to Vercellonius, a gland which he ſays is equal to a kidney-bean in ſize; he alſo ſays that it has ducts opening into the cavity of the ſtomach. In hogs this gland is very conſpicuous, but in human ſubjects it is not ſo. Many authors have told us, that in the omentum, in every part where the fat lies, there are a number of glands whoſe office it is to ſecrete it. Diſſection ſhews us a few about that part where it is joined to the pylorus; and as to the reſt, it is not neceſſary that there ſhould be glands becauſe there is fat: for that may be, and is, indeed, in great abundance ſecreted immediately from the arteries. In the gall-bladders of oxen, there are often found a number of ſmall glands, of a yellow colour, not unlike the ceruminoſe glands in the auditory paſſage; in human ſubjects the ſame kind of glands are alſo ſometimes found. The bladder and the ureters have alſo ſometimes a number of ſmall glands, but they are very indeterminate in number and ſize, and are not always indeed found in the ſame place, eſpecially about the ureters. Thoſe about the bladder are uſually ſituated towards the neck of it, and are ſometimes tolerably conſpicuous. For the glands in the parts of generation of both ſexes, ſee Chap. viii. Sect. 2.

CHAP. VI.

SECT. I.

Of the ARM and its PARTS.

Arm and its parts.

THE arm comprehends the whole limb or member, from the top of the ſhoulder to the finger's ends; to which I ſhall add the clavicle and ſcapula with the muſcles thereto belonging. The whole arm is divided (as in the ſkeleton) into the ſhoulder, including the ſcapula and clavicle; the arm, properly ſo called; the fore-arm and hand, including the fingers. The upper part of the arm, which joins with the ſcapula or ſhoulder-bade and clavicle, is termed humerus, which extends to the elbow or back-ſide of the bend of the arm termed olecranon; the fore-ſide or flexure is called ancon; from thence toward the hand is called the fore-arm or cubitus; the end of which towards the hand is the wriſt or carpus; between the carpus and the fingers is the metacarpus; to which is articulated pollex the thumb, index the fore-finger, digitus medius the middle-finger, digitus annularis the ring-finger, and digitus minimus the little-finger.

SECT. II.

Of the BONES of the ARM, &c.

Bones of the arm. THE bones of the arm, including the ſcapula, clavicle, hand, and fingers, are thirty-two (beſides the ſeſamoidal bones, whoſe number is uncertain) viz. ſcapula, clavicula, humerus, ulna, radius, each one; carpus, eight; metacarpus, four; phalanges of the fingers and thumb, fifteen; as may be ſeen at one view in the table of oſteology.

Clavicula. Clavicula is ſituated tranſverſely on each ſide, between the ſcapula and ſternum; its figure is ſomewhat like that of the letter S and it is of a ſpungy and brittle ſubſtance. One end is connected to the ſternum with a looſe cartilage, and the other to the proceſſus acromium of the ſcapula. The uſes of the clavicles are, to keep the ſcapulæ at a ſufficient diſtance from the breaſt, by which means the ſhoulders are hindered from coming near together, as they do in thoſe quadrupeds which uſe their fore-limbs only to walk on, and not as men do their hands; to facilitate ſeveral of the motions of the arm; to ſerve for the place of origin for ſeveral muſcles; and to defend the great ſubclavian veſſels which run under them.

Scapula. The ſcapula, or ſhoulder-blade, is a triangular bone, ſituated on the back and outſide of the ribs, and commonly extended from the ſecond to the ſeventh. It is fixed to the ſternum by the clavicula, but its chief connection is with the ribs and ſpine, by thoſe muſcles which are made alſo for its various motions. The ſubſtance of the ſcapula is thin, but ſolid and firm; its outſide is a little convex, and its inſide ſomewhat concave, to fit it to the outer ſurface of the ribs on which it moves, and partly to give room for the ſubſcapularis muſcle. Its upper edge is called coſta ſuperior (though very improperly, being thin) and its lower coſta inferior; its broad end is called its baſis, which, with the two edges, make the upper and lower angles. They have each three proceſſes, of which the firſt runs all along the middle of their outſide, and is called their ſpine. That end of the ſpine which receives the extremity of the clavicula is called proceſſus acromion. The ſecond proceſs is a little lower than the acromion; it is ſhort and ſharp like a crow's bill, whence it is called coracoides; theſe two proceſſes are tied to each other by a ſtrong flat ligament, which ſerves to keep the head of the humerus in the cavity of the third proceſs, and prevents its being diſlocated upwards. This proceſs is the extremity of the ſcapula, which is oppoſite to its baſis. Its has a round ſinus, tipt about its brim with a cartilage, which receives the head of the humerus. At the fore-part of this edge, cloſe to the coracoid proceſs, is a ſemicircular nitch for the paſſage of blood-veſſels, which nitch is joined at the top with a ligament, and ſometimes with a bone. The uſe of the ſcapula is to receive the extremities of the clavicula and humerus, for the eaſier motion of the arm, and to give riſe to the muſcles which move the arm.

Os humeri. Os humeri is the large bone of the arm, ſituated between the ſhoulder and the cubit,

bit, articulated at one end with the ſcapula, and at the other with the ulna and radius. Its upper end or head, where it is joined to the ſcapula, is ſomewhat flat and much larger than the ſocket which receives it. At the upper part are two proceſſes for the inſertions of muſcles of the arms: between theſe proceſſes is a long channel or groove, in which lies a tendon of the biceps cubiti. At the lower end are two conſiderable proceſſes, both formed to give origins to muſcles of the wriſt and fingers; between theſe proceſſes is the joint. That part to which the upper end of the radius is fixed, is fitted not only for the motion of the elbow, but alſo for the rotatory motion of the radius; the reſt of this joint is made up of portions of unequal, but concentric, circles, like the ſhanks of quadrupeds; which inequality prevents the ulna from diſlocating ſideways, which ſo ſmall a joint with ſo much motion would be very ſubject to. Of a like uſe is the little ſinus on the fore-part of the humerus, and the large one behind; the firſt of which receives a proceſs of the ulna when the arm is bent, and the other the olecranon, when the arm is extended. The os humeri has evidently the moſt free and extenſive motion of any bone in the human body.

Ulna is one of the bones of the fore arm or cubit; reaching from the elbow to the wriſt; it is big at its upper extremity, and grows gradually ſmaller towards its lower end. This bone is longer than the radius, and has a motion of flexion and extenſion: at its upper extremity it articulates with the os humeri and the criſta of the radius, and its lower extremity articulates with the carpus, Ulna.

pus, as alſo with the radius by means of a criſta. At the upper end it has one large proceſs or apophyſis called olecranon, and a ſmall proceſs on the fore-part; and on one ſide between there is alſo a ſmall cavity, which receives the upper end of the radius for its rotatory motion; and down the ſide of this bone, next the radius, is a ſharp edge, from which the ligament ariſes which connects theſe bones together. At the lower end is a proceſs called ſtyliformis, and a round head, which is received into the radius for the rotatory motion of the cubit.

Radius. Radius is the exterior bone of the cubitus or fore-arm, deſcending along with the ulna from the elbow to the wriſt. In its upper extremity there is a glenoide cavity for its articulation with the humerus, which chiefly fits it for its rotatory motion, being alſo received into the ulna; for the ſtrength of the elbow-joint receives but little advantage from the union of theſe two bones. A little below this head is a large tubercle, into which the biceps muſcle is inſerted, which by the advantage of this inſertion turns the cubit ſupine, as well as bends it. At the lower end, which is thicker, is a ſocket to receive the carpus, and at the ſide next the ulna a ſmall one to receive that bone, and a thin edge, into which the tranſverſe ligament, which ariſes from the ulna, is inſerted. This ligament ties theſe bones conveniently and firmly together; for the ulna being chiefly articulated to the os humeri, and the radius to the carpus, a weight at the hand, without this ligament, would be liable to pull theſe bones aſunder.

Carpus, the wriſt, conſiſts of eight ſmall, **Carpus.** unequal, and irregular bones, divided into two rows; the firſt row lies next the fore-arm, the ſecond next the metacarpus; each row conſiſts of four bones, in the firſt are the os ſcaphoides or naviculare, lunare, cuneiforme, and orbiculare; in the ſecond are the os trapezium, trapezoides, magnum and unciforme. It is to no purpoſe to enter into a minute deſcription of theſe ſmall bones, therefore let it ſuffice to ſay, they have all obſcure motions one with another, and with thoſe of the metacarpus; but the motion of thoſe of the firſt row with thoſe of the ſecond is more conſiderable, and they are moved by the ſame muſcles which move the carpus on the radius.

Metacarpus is that part of the hand be- **Metacarpus** tween the wriſt and the fingers; the inner part is called the palm, and the other the back of the hand. The metacarpus conſiſts of four bones, which anſwer to the four fingers, whereof that which ſuſtains the fore-finger is the biggeſt and longeſt, but has the leaſt motion, and that of the little finger the moſt. They are all round and long, a little convex towards the back of the hand, and concave and plain towards the palm. They are hollow in the middle, and full of marrow; they touch one another only at their extremities, having ſpaces in the middle in which lie the muſculi interoſſei. In the upper end of theſe bones there is a ſinus which receives the bones of the wriſt; the other ends have round heads, which are received into the ſinus of the firſt bones of the fingers.

Digiti, the fingers.

Digiti, the fingers, are four in number on each hand, excluſive of the thumb. They are diſtinguiſhed as follows, 1. index, the fore-finger; 2. medius, the middle-finger; 3. annularis, the ring-finger; 4. minimus vel auricularis, the little-finger. In the thumb and fingers are three bones, which make three phalanges, the upper of which (next the metacarpus) are much larger than the lower next the extremities. Theſe bones, on the inſide, are flat and a little hollow or concave, which is neceſſary to make room for the flexors of the fingers, and to render their ſhape proper for graſping any thing; but this conſequently weakening them in the middle, where they are moſt liable to be broke, ſuch inconvenience is provided againſt by a larger ſubſtance. The thumb is ſhorter and ſtronger than any of the fingers, becauſe in its actions it is to reſiſt them all.

The firſt phalanx, in the part where they are articulated with the bones of the metacarpus at their heads, have a glenoide cavity, by means of which articulation, they have a free motion every way. In the other extremity, there are two heads with two cavities joined to the ſecond phalanx, where the motions of flexion and extenſion are all that are poſſible; and the ſame is the caſe between the ſecond phalanx and the third.

SECT.

SECT. III.

Of the CARTILAGES, LIGAMENTS, &c. of the ARM, &c.

Cartilages, &c. of the arm, &c.

THE cartilages, ligaments, &c. of the arm, &c. are thoſe of the bones of the ſhoulder, os humeri, fore-arm, and hand.

Cartilages of the bones of the ſhoulder.

The glenoide cavity of the ſcapula, which receives the ſuperior head of the os humeri, is covered with a cartilage, which is thicker toward the circumference than in the middle, and a little raiſed above the edge of the bone. It is of a pliable ſlippery ſubſtance, yet ſomething different from that of a cartilage, reſembling in ſome meaſure the border of the acetabulum coxendix. The acromion has alſo a ſmall cartilaginous ſurface, as has the ſmall triangular ſurface, at the extremity of the ſpine of the ſcapula, near the baſis. The external extremity of the clavicle is cruſted over with a cartilage, which is a little convex and covers its whole triangular ſurface; beſides which, it has another moveable common cartilage already ſpoken of. The ſmall cartilaginous ſurface of the humeral extremity of the clavicle, anſwering to that of the acromion, is, like that of the acromion, a little convex. Between theſe two cartilages of the clavicle and acromion, there is in ſome ſubjects a thin inter-articular cartilage, very ſmooth on both ſides.

Cartilages of the os humeri.

The cartilage by which the hemiſphere of the head of the os humeri is covered, is gradually thicker toward the middle than toward the edges. The groove in the os hu-

humeri is covered by a cruſt which is partly ligamentary and partly tendinous rather than cartilaginous. The lower head of the os humeri is covered by a common cartilage, and its foſſulæ near the head with a thin cartilaginous or ligamentary varniſh.

Cartilages of the bones of the fore-arm.

The two ſigmoide cavities in the upper extremity of the ulna are covered by a cartilage common to both, which ſeems to be thicker at the edges than in the middle. The lower head of the ulna is cruſted over by a cartilage, round its cylindrical border, and ſome part of the apophyſis. The head of the radius is covered in the ſame manner. All the concave ſide of the baſis of the radius is cartilaginous, and often divided by a ſmall cartilaginous prominent line. At the baſis of the radius there is likewiſe a particular additional cartilage, or triangular production longer than it is broad, very thin, and rather flat than concave on both its ſmooth ſides. This cartilage may be termed the inter-articular cartilage of the joint of the wriſt. It is tied to the radius by very ſhort ligaments, and ſliding on the ſmall head of the ulna, it follows all the motions of the radius.

Cartilages of the bones of the hand.

All the bones of the carpus, metacarpus, and fingers, are cruſted over with cartilages at their ends for their mutual articulations, which may be termed cartilaginous ſurfaces, in which the impreſſions and notches where the mucilaginous glands are lodged are very perceptible.

Ligaments of the bones of the ſhoulder.

The articulation of the acromion with the extremity of the clavicle, is ſtrengthened quite round by ſeveral ſmall ſtrong ligaments, which go from one bone to the other.

Theſe ligaments lie very near each other, and are withal ſo tightly braced over the joint, as to hide it altogether, and they appear more like a cartilaginous covering than a ligamentary texture. The internal ſurface of theſe ligaments is lined with the capſula of the joint. When the ſmall inter-articular cartilage is found, its whole circumference is connected to theſe ligaments. The articulation of the clavicle with the ſternum is ſuſtained by ſeveral ligaments fixed by one end round the pectoral extremity of the clavicle, and by the other to the ſternum, as before obſerved. There is a long, narrow, ſtrong ligament, which goes from one clavicle to the other, behind the furca of the ſternum, and may be called the inter-clavicular ligament.

The neck of the ſcapula, at a ſmall diſtance from the edge of the glenoide cavity, gives inſertion to the capſular ligament or mucilaginous bag, and to the articular ligaments of the joint of the ſcapula and os humeri. Beſides the articular ligaments of the ſcapula, there are three ligamentary cords fixed to the tuberoſity of the coracoide apophyſis; two are inſerted by the other end in the extremity of the clavicle, and the third under the acromion. A thin broad ligament alſo reaches between the criſta of the ſpine of the ſcapula and the edge of its inferior coſta.

Ligaments of the os humeri.

The capſular or mucilaginous ligament looſely ſurrounds the whole articulation of the ſcapula with the head of the os humeri; from its inſertion round the edge of the glenoide cavity, already mentioned, it is continued over the hemiſphere of the head

of

of the os humeri, and fixed near its edges towards the muſcular ſurfaces of the great and ſmall tuberoſities or proceſſes. Afterwards it runs down gradually on the neck of the bone below the loweſt part of the cartilaginous hemiſphere, and is cloſely fixed in the bone, except in the groove or channel already mentioned, in which lies the tendon of the biceps cubiti. The true ligament of this joint ſeems to be made up of two ſorts of ligaments cloſely united together, viz. a capſular ligament which ſurrounds the whole articulation; and ſeveral true ligaments which run over, and cloſely adhere to the former at different diſtances. On the body ofth e os humeri there are two long, flat, thin, ſtrong, and narrow ligaments, fixed by one edge along the two lower thirds of the bone reaching to both condyles. The lower extremity of the os humeri is joined to the bones of the fore-arm by two faſciculi of ligamentary fibres, one fixed to the inner condyle, the other to the external. The capſular ligament is fixed to the condyles, and there covers them; and afterwards it is fixed round both ſides of this lower extremity above the foſſulæ, which foſſulæ is only ſlightly varniſhed over with a cartilaginous ſubſtance.

Ligaments of the bones of the fore-arm.

Some of the ligaments of the bones of the fore-arm are common to them with the os humeri, ſome common to them with the bones of the hand, and ſome are proper. The two proper are the interoſſeos ligament of the fore-arm, and one which may be termed the coronary ligament of the radius. To theſe may be added the annular ligaments, which only ſerve for the paſſage of tendons; and other ligamentary expanſions, which may be called muſcular ligaments; but the deſcription of the latter I ſhall refer to the muſcles. The interoſſeos ligament of the fore-arm is very like that of the leg. It is fixed by one edge along the ſharp angle of the ulna, and by the other along that of the radius; in it are holes for the paſſage of the blood-veſſels. This ligament ties the two bones cloſely together, and ſerves for the inſertion of ſeveral muſcles. In the ſupination, or turning up the palm of the hand, it is very tightly braced; but in pronation, or turning down the palm, it is folded a little lengthwiſe. The coronary ligament ſurrounds the circular circumference of the head of the radius; it is very ſtrong, and comes near the ſolidity of a cartilage. The ſide next the radius is very ſmooth, and though it connects that bone very cloſely to the ulna, yet it leaves room enough to turn in the motions of pronation and ſupination. The capſular ligament of the joint of the elbow runs down from its inſertion in the os humeri already deſcribed, and is fixed in the olecranon, round the edge of the great ſigmoide cavity, including both the apex of the olecranon and of the coronoide apophyſis. It likewiſe runs over the head of the radius, and is fixed to the coronary ligament quite round. Thus it completely ſurrounds the articulation of theſe three bones, and ſerves to contain the mucilaginous liquor furniſhed by the glands and fatty ſubſtance, both which are found in the greateſt quantities near the extremity of the ulna. The true common ligaments by which the os humeri is connected to the bones of the fore-arm, called lateral ligaments, are the two faſciculi, which after being inſerted in the condyles of the os humeri are expanded like a gooſe's foot. That which is fixed in the inner condyle, may be called brachio-cubitale, and the other brachio-radiale. The brachio-cubitale running down over the capſula to which it cloſely adheres, below the great edge of the trochlea of the os humeri, is inſerted like radii on the ſide of the great ſigmoide cavity of the ulna. It is covered on the outſide by ſeveral tendons which adhere cloſely to it, and ſeem to ſtrengthen it. The brachio-radiale ligament is diſpoſed much after the ſame manner, but is of a greater extent. It is expanded from the external condyle of the os humeri, as from a center, and is inſerted round the coronary ligament, from thence all the way down to the neck of the radius, and alſo in the neighbouring parts of the ulna. Through all this paſſage it covers the capſular ligament, and is covered by ſeveral tendons, adhering cloſely to both. Of the ligaments by which theſe bones are connected to thoſe of the hand, one is like a roundiſh cord, fixed in the ſtyloide apophyſis of the ulna, and in the os cuneiforme and bones of the carpus. Another pretty broad ligament is fixed in the point of the radius and in the bones of the carpus. From this ſtyloide ligament proceed a number of ligamentary fibres much in the ſame direction. Thoſe neareſt the ulna incloſe the inter-articular cartilage of the baſis of the radius. All theſe ligaments ſurround and cover the capſular ligament ſo cloſely that they can hardly be diſtinguiſhed from it. The capſula is likewiſe in part covered by a portion of a great oblique ligament, which is fixed by a very broad inſertion in the large extremity of the radius, a little above the ſtyloide apex, and paſſing obliquely, is inſerted into the os orbiculare. It is called the external tranſverſe ligament of the carpus; and may likewiſe be named the great oblique ligament of the wriſt. There are ſeveral ſmall annular ligaments placed at different diſtances on the convex ſide of the baſis radii, from its ſtyloide apex to its articulation with the extremity of the ulna. They are at leaſt ſix in number, ſome of them being often double or triple. Theſe particular ligaments are almoſt wholly covered by the great oblique ligament already mentioned, and are fixed as ſtrongly in it by one ſide, as they are in the bones by the other.

Ligaments of the bones of the hand.

The ligaments of the carpus are very numerous. Some of them tie each bone to one or two neighbouring bones in the ſame rank; and theſe are compoſed of a great number of filaments, but ſo very ſhort as to allow theſe bones only a ſmall degree of motion. Some of them tie the bones of one row to thoſe of the other; which are likewiſe made up of many filaments, but not ſo ſhort as the former, and therefore allow theſe bones a more manifeſt motion, as we ſee in bending the wriſt. Laſtly, there are other ligaments of the carpus by which the three firſt bones of the firſt row are connected to the bones of the fore-arm; and to theſe may be added the ligaments by which the bones of the ſecond row are joined to thoſe of the metacarpus and firſt phalanx of the thumb. I have already deſcribed all the ligaments belonging to the articulation of the carpus with the bones of the fore-arm, except their inſertion in the carpus. The ſtyloide ligament of the radius is fixed round the neighbouring tuberoſity of the os ſcaphoides vel naviculare. The ſtyloide ligament of the ulna is fixed firſt in the os cuneiform, and then in the os unciforme, from whence it is a little ſtretched over the fourth bone of the metacarpus. The ligaments which lie between the two former, round the baſis of the radius, and a ſmall portion of the head of the ulna, are fixed round the common convexity of the three firſt carpal bones, as is alſo the mucilaginous capſula by which theſe ligaments are lined. Beſides all theſe ſmall ſhort ligaments, the rough ſurface of all the carpal bones gives inſertion to a great many ligamentary faſciculi, ſtretched over and cloſely united to the former. There is likewiſe a conſiderable ligament, called the inner tranſverſe ligament, formerly called an annular ligament.

The bones of the metacarpus, beſides the ſhort ligaments by which they are tied to the ſecond row of the bones of the carpus, have ſeveral others, by which both their baſes and heads are connected together. The baſes of the third and fourth bones are not ſo cloſely tied as the reſt, and therefore they have a very ſenſible motion, which, however, is greater in the fourth than in the third. The heads of theſe bones are firmly tied to each other by a ſtrong tranſverſe ligament, ſituated in the palm of the hand, fixed in the neighbouring part of the heads, ſo as to form a kind of perforated fræna, through which the tendons of the flexor muſcles of the fingers have a free paſſage.

The firſt phalanx of the thumb and fingers is fixed by ſhort ligaments that paſs obliquely over the articulation with the metacarpal bones, which are ſtrengthened by adhering to the tranſverſe ligament already mentioned. The ſecond phalanx of the thumb is joined to the firſt by ligaments of the ſame kind. The other phalanges are joined by lateral ligaments almoſt in the ſame manner as the bones of the fore-arm to the os humeri. The two firſt phalanges of each finger have a very ſtrong ligamentary vaginæ inſerted in the rough ridges on their flat ſides. Theſe vaginæ are lined with a mucilaginous membrane, which runs like a tube from one phalanx to the other, over the articulation. They ſerve for fræna to the flexor muſcles of the fingers, the tendons of which paſs through them.

SECT. IV.

Of the MUSCLES of the ARM, &c.

Muſcles of the arm, &c.

THE muſcles of the arm and its parts include thoſe of the clavicle, ſcapula, and breaſt, which belong thereto, though ſituated on the ſuperior part of the trunk; for this reaſon their deſcription was omitted in the Chapter Of the Thorax and its Parts.

Subclavius.

Subclavius is a ſmall oblong muſcle lying between the clavicle and firſt rib; it ariſes from the ſuperior part of the firſt rib, and is inſerted into almoſt all the middle portion of the under-ſide of the clavicula. Its uſe is to draw the clavicula toward the ſternum, that they may not be ſevered in the motions of the ſcapula.

Trapezius. Trapezius, vel cucullaris, is a muſcle of the ſcapula, which ariſes from the os occipitis and from a linea alba colli, from the ſpinal proceſs of the laſt vertebra of the neck, and the ten uppermoſt of the back, and from a linea alba between all theſe proceſſes; it is inſerted into one third of the clavicle next the ſcapula, almoſt all the back part of the ſpine of the ſcapula, and as much of the proceſſus acromion as lies between the ſpine of the ſcapula and the clavicle. This muſcle draws the ſcapula directly backward; other actions attributed to this muſcle by many authors, I think erroneous.

Rhomboides. Rhomboides is a thin, broad, and obliquely ſquare, fleſhy muſcle, ſituated between the baſis of the ſcapula and the ſpina dorſi. It ariſeth from the ſpinal proceſs of the two inferior vertebræ of the neck, and the four ſuperior of the back; and is inſerted into the whole baſis of the ſcapula, which it draws up and backward. The upper part of this muſcle ariſing from the neck is in many bodies, by the motions of the neck, ſeparated, and made a diſtinct muſcle.

Elevator ſcapulæ. Elevator ſcapulæ is a long and pretty thick muſcle, about two fingers breadth; it ariſes from the tranſverſe apophyſes of the four firſt vertebræ of the neck, and running a little obliquely is inſerted into the upper angle of the ſcapula for its elevation.

Serratus major anticus. Serratus major anticus is a broad, fleſhy, and pretty thick muſcle, ſituated on the lateral part of the thorax, between the ribs and the ſcapula, by which it is covered. It ariſes by dentated origins (reſembling a ſaw, from whence the name of ſerratus) from the anterior part of the eight ſuperior ribs, and is inſerted into the baſis of the ſcapula, which it draws forward and upward. This muſcle is ſaid to be an elevator of the ribs, though each portion of it is nearly parallel to the rib it riſes from.

Serratus minor anticus.

Serratus minor anticus, vel pectoralis minor, ariſes from the third, fourth, and fifth ribs, continues its courſe under the pectoralis major, and is inſerted into the proceſſus coracoides ſcapulæ, which it pulls forward and downward. This is alſo accounted by anatomical writers an elevator of the ribs, though it ariſes from the ſcapula which is ſupported by the ribs.

All the muſcles inſerted into the baſis of the ſcapula are alſo inſerted into one another.

Pectoralis.

Pectoralis, by ſome called pectoralis major, poſſeſſes almoſt the whole breaſt, being a large thick fleſhy muſcle, covering the forepart of the breaſt, from the ſternum, where it is very broad, to the axilla, where it contracts in its paſſage to the arm. It ariſes from near two thirds of the clavicula, next the ſternum, and all the length of the os pectoris, and from the cartilages of the ribs; and is inſerted into the os humeri about four fingers breadth below its head, between the biceps and the inſertion of the deltoides. The uſe of it is to draw the arm forward. A ſmall portion of the lower part of this muſcle is often confounded with the obliquus deſcendens abdominis; in ſome bodies neither the upper part nor its tendon can be eaſily ſeparated from the deltoides; and in others, even that part of it that ariſes from the clavicula is a diſtinct portion. Naturaliſts obſerve a ſingular mark of Providence in the ſize and ſtrength of the pectoral muſcle in different animals. It is by the action of this muſcle, that the flying of birds is chiefly performed; and therefore it is much larger and ſtronger in birds than in animals not made for flight.

Deltoides. Deltoides is a very thick, triangular muſcle, covering the upper part of the arm, and forming what is called the ſtump of the ſhoulder. It is one of the elevators of the arm. It ariſes from the clavicula, acromion, and ſpine of the ſcapula, and is inſerted near the middle of the os humeri, which bone it lifts directly upward.

Supra ſpinatus. Supra ſpinatus, vel ſuper ſcapularis ſuperior, ariſes from the dorſum ſcapulæ above the ſpine, and paſſing between the acromion and neck of the ſcapula, and under the ligament between the acromion and proceſſus coracoides, it is inſerted into the upper part of the os humeri near its groove or bony channel. It helps to lift the arm upwards until it becomes parallel with the ſpina ſcapulæ.

The ſupra ſpinatus, deltoides, and coraco-brachialis, aſſiſt in all the motions of the humerus, except depreſſion; it being neceſſary that the arm ſhould be raiſed and ſuſtained, in order to move it to any ſide.

Infra ſpinatus. Infra ſpinatus vel ſuper ſcapularis inferior, ariſes from the dorſum ſcapulæ below the ſpine, and is inſerted, wrapping over part of it, at the ſide of the head of the os humeri; it turns the arm ſupine and backward.

Teres minor is an abductor muſcle as well as the infra ſpinatus, below which it has its origin from the inferior coſta of the ſcapula, and is inſerted together with the infra ſpinatus, which it aſſiſts in turning the arm ſupine, but pulls it more downwards. Teres minor.

Teres major is a depreſſor muſcle, which has its origin at the lower angle of the ſcapula, and is inſerted at the under part of the os humeri about three fingers breadth from the head. This muſcle draws the os humeri toward the lower angle of the ſcapula, and turns the arm prone and backward. Teres major.

Latiſſimus dorſi is a very broad muſcle, covering almoſt the whole back; it has a thin, broad, tendinous beginning, which ariſes from the ſpinal proceſſes of the ilium, os ſacrum, vertebræ of the loins, and from the ſeven inferior vertebræ of the thorax; and growing fleſhy, after it has paſſed the extenſors of the trunk, receives ſome fleſhy fibres from the ninth, tenth, and eleventh ribs, and is inſerted into the os humeri with the teres major, by a ſtrong and broad tendon, with which it pulls the arm downward and backward. The tendinous origin of this muſcle ſerves for a membrane to the extenſors of the back, and is connected to the tranſverſe proceſſes of the vertebræ lumborum. Latiſſimus dorſi.

Subſcapularis is a muſcle of the ſame breadth and length with the ſcapula, filling up the hollow or under ſide of it (whence its name) from which it ariſes, and is inſerted into the neck of the os humeri, wrapping ſomewhat over it. This muſcle pulls the arm to the ſide and prone. Subſcapularis.

Coraco-brachialis.

Coraco-brachialis ariſes from the proceſſus coracoides ſcapulæ, and paſſing over the articulation is inſerted into the middle and internal part of the humerus; this, with the deltoides and ſupra-ſpinatus, lifts the arm upwards, and turns it ſomewhat outward.

Biceps cubiti flexor.

Biceps cubiti flexor ariſes with two heads, that the fibres of this muſcle ſhould not compreſs one another. One head ariſes with a long, round tendon, from the upper edge of the acetabulum ſcapulæ, running under the ligament of the articulation, in a channel or groove on the head of the ſhoulder-bone (before mentioned) wherein it is incloſed by a proper ligament, afterwards it becomes fleſhy, and joins the other head, which ariſes from the proceſſus coracoides ſcapulæ in common with the coraco-brachialis muſcle, and is inſerted with the firſt head into the tubercle, at the upper head of the radius. Sometimes this muſcle has a third head, which ariſes from the middle of the os humeri. This muſcle lifts up the humerus, bends the cubit, and has as great a ſhare as any one muſcle in turning the cubit ſupine; the humerus being fixed by other muſcles, the whole force of this muſcle will be exerted upon the cubit, or the cubit being fixed by an extenſor, the whole force of it will be ſpent in raiſing the arm, and therefore ought to be always reckoned among thoſe that raiſe a weight at arm's length.

Injudicious blood-letters ſometimes prick the tendinous expanſion of this muſcle (in the flexure of the cubit) which generally occaſions a moſt violent pain and inflammation, and has been attended with fatal conſequences. The great miſchief ariſing from pricking this tendinous faſcia, ſeems owing to its lying ſo much upon the ſtretch, which may be wholly avoided by bending the elbow, and turning the cubit bone.

Brachiæus internus.

Brachiæus internus lies partly under the biceps, and ariſes from the internal part and below the middle of the os humeri, near the inſertion of the deltoides and coracobrachialis muſcles; it is inſerted in the tubercle of the ulna, a little below its upper head. This muſcle helps alſo to bend the arm.

Supinator radii longus.

Supinator radii longus has its origin from the exterior part of the humerus, and is inſerted into the upper ſide of the radius near the carpus. This muſcle, ſome ſay, is not a ſupinator but a bender of the cubit, and that with a longer lever than either of the two former muſcles, and is leſs concerned in turning the cubit ſupine, than either the extenſors of the carpus, fingers, or thumb.

Supinator radii brevis.

Supinator radii brevis ariſes from the lower part of the external condyle of the os humeri, and from the upper part of the ulna, and running half round the radius, is inſerted near its tubercle. This muſcle ſerves alſo to turn the palm of the hand upward, and to bend the cubit.

Triceps extenſor cubiti.

Triceps extenſor cubiti, vel brachiæus externus, is divided into three heads; the firſt ariſes from the inferior coſta of the ſcapula near the acetabulum; the ſecond, from the outer and back part of the os humeri; the third, lower and more internal; and are inſerted into the proceſſus olecranon of the ulna. The firſt of theſe heads draws the arm backward, with as long a lever as it extends the cubit.

Anconæus. Anconæus ariſes from the back-part of the extremities of the humerus paſſes over the elbow, and is inſerted into the upper part of the ulna. This muſcle is alſo an extenſor of the cubitus.

Palmaris longus. Palmaris longus ariſes from the inner condyle of the os humeri; it ſoon after becomes a tendon, joins the ligamentum tranſverſale carpi, and is expanded in the palm of the hand. This muſcle is often wanting, but the expanſion in the hand never; yet being connected to the ligament of the carpus, it muſt bend the carpus, and cannot conſtrict the palm of the hand; and when it is wanting the flexor carpi radialis is larger.

Palmaris brevis. Palmaris brevis, or caro quadrata, is in form of a ſmall maſs of fleſh, very different in ſize in different bodies. It ariſes obſcurely from the ligamentum tranſverſale carpi, and ſeems to be inſerted into the eighth bone of the carpus and the metacarpal bone of the little finger. This helps to conſtrict the palm of the hand.

Flexor carpi radialis. Flexor carpi radialis ariſes from the inner extuberance of the os humeri, and ſoon becoming a ſtrong tendon, paſſes through a channel of the fifth bone of the carpus, and is inſerted into the metacarpal bone of the fore-finger. This not only bends the carpus upon the radius, but alſo the bones of the ſecond order upon thoſe of the firſt, which motion is nearly as much as that upon the radius.

Flexor carpi ulnaris. Flexor carpi ulnaris ariſes from the ſame tubercle of the humerus as the former, and a faſcia betwixt this muſcle and the tenſor ulnaris contiguous to the ulna, and is inſerted by a ſhort tendon into the fourth bone of the carpus.

Extenſores carpi radiales. Extenſores carpi radiales; the firſt ariſes from the os humeri immediately below the ſupinator radii longus, and is inſerted into the metacarpal bone of the fore-finger; the ſecond ariſes immediately below the firſt, from the external protuberance of the os humeri, and is inſerted into the metacarpal bone of the middle finger. The firſt of theſe muſcles is a bender of the cubit, as well as an extenſor of the carpus, and its often acting with the benders of the cubit, while the other is not in action, is the reaſon why it is ſo diſtinct from it.

Extenſor ulnaris. Extenſor ulnaris ariſes from the ſame extuberance with the former, and half the ulna below the anconæus muſcle; then, becoming a tendon, it runs in a ſmall ſinus at the bottom of the ulna, and is inſerted into the metacarpal bone of the little-finger. The extenſors of the carpus being inſerted into the metacarpus, at once perform the motion between the bones of the carpus, and that between the carpus and radius. The flexor and tenſor ulnaris acting together turn the hand downward, the tenſor and flexor radialis upward.

Pronator quadratus. Pronator quadratus vel tranſverſus, lies tranſverſely on the inſide of the lower extremity of the fore-arm; it ariſes from the lower part of the ulna near the carpus, and paſſing under the flexors of the fingers, is inſerted into the lower extremity of the radius.

Pronator teres. Pronator teres, vel obliquus, is ſituated in the upper part of the ulna, oppoſite to the ſupinator brevis. It ariſes from the internal condyle of the os humeri, and upper and fore-part of the ulna, and is inſerted into the radius below the ſupinator brevis.

The ſupinator and pronator muſcles are occaſionally aſſiſted in their actions by the muſcles of the hands, the extenſors aſſiſting the ſupinators, and the flexors the pronators, and moſt of the extenſors of the hand take a great part of their origin from the tendinous faſcia that covers them.

Perforatus, &c. Perforatus, or flexor ſecundi internodii digitorum, called alſo ſublimis, ariſes from the inner tubercle of the os humeri, and from the upper part of the ulna, and the middle of the radius; then becoming four ſtrong tendons, it paſſes under the ligamentum tranſverſale carpi, and is inſerted into the beginning of the ſecond bone of each finger. The name of ſublimis has been given to this muſcle, becauſe it lies almoſt on the ſurface of the fore-arm; and that of perforatus, from the ſlits found near the extremities of its tendons.

Perforans, &c. Perforans, or flexor tertii internodii digitorum, ariſes from half the ulna, and a great part of the ligament between the ulna and radius, then becoming four tendons, paſſes under the ligamentum tranſverſale carpi, and through the tendons of the former muſcle to their inſertion into the third bone of each finger. The tendons of both theſe muſcles are tied down to the fingers by a ſtrong ligament. If theſe muſcles had not paſſed one through the other, the perforatus, which is the leſſer muſcle, muſt have gone to the laſt joint where the ſtronger muſcle is wanted; and beſides, the tendons of the ſecond joints would have preſſed thoſe that bend the laſt, and not lain firmly upon them neither.

Lumbricales, or flexores primi internodii digitorum ariſe from the tendons of the laſt mentioned muſcle, and are inſerted laterally toward the thumb into the beginning of the firſt bone of each finger. Lumbricales.

Extenſor digitorum communis ariſes from the external protuberance of the humerus, and at the wriſt it paſſes under a ligament and divides into four tendons, which are afterwards inſerted into the beginning of the ſecond bone of each finger. Theſe tendons communicate upon the firſt joint, which keeps them from ſliding off the joints of the fingers, being a little connected to the firſt bones. Extenſor digitorum communis.

Extenſor auricularis, or minimi digiti is a portion of the laſt muſcle, paſſing under the ligament in a diſtinct channel. Extenſor minimi digiti.

Extenſor indicis comes from the middle and external part of the ulna, and paſſing under the ligament of the carpus is inſerted with the extenſor communis into the fore-finger. This muſcle extends the fore-finger ſingly. Extenſor indicis.

Abductor primi digiti interoſſei, and abductor minimi digiti, are eight muſcles, one for each ſide of each finger. Abductor primi digiti ariſes from the firſt bone of the thumb, and the ſide of the metacarpal bone of the fore-finger. The interoſſei are three pair, fitly divided into external and internal; the external ariſe from the metacarpal bones, whoſe ſpaces they fill up next the back of the hand; the internal ariſe from the ſame bones in the inſide of the hand. Abductor primi digiti interoſſei, &c.

Abductor minimi digiti.

Abductor minimi digiti ariſes from the tranſverſe ligament and fourth bone of the carpus; theſe muſcles are inſerted, two into the firſt joint of each finger, and then paſſing obliquely over the tops of the fingers, are inſerted into their laſt bones; they bend the firſt joints, and extend the two laſt, as in holding a pen, and in playing upon ſome muſical inſtruments. The abductors of the fore and little-fingers, with the ſecond and fifth interoſſei muſcles acting, the fingers are divaricated, and the other four acting bring them together; theſe muſcles which divaricate the fingers, being extenders of the ſecond and third joints, we never can divaricate them without extending them a little.

Abductor oſſis metacarpi minimi digiti.

Abductor oſſis metacarpi minimi digiti ariſes from the eighth bone and tranſverſe ligament of the carpus, and is inſerted into the metacarpal bone of the little-finger, which it pulls toward the thumb to conſtrict the palm of the hand.

Extenſor primi internodii pollicis

Extenſor primi internodii pollicis ariſes from the ulna, below the anconæus muſcle and the ligament between the ulna and radius; then becoming two, three, or four tendons, is inſerted into the fifth bone of the carpus, and firſt of the thumb. The firſt of theſe inſertions can only aſſiſt the bending of the wriſt upward, and in turning the arm ſupine.

Extenſor ſecundi internodii pollicis.

Extenſor ſecundi internodii pollicis ariſes immediately below the former from the radius and tranſverſe ligament, and is inſerted by a few fibres into the ſecond bone of the thumb, but chiefly into the third.

Extenſor tertii inter-

Extenſor tertii internodii pollicis ariſes immediately below the laſt deſcribed, from the ulna and ligament, and paſſes over the radius nearer the ulna, to be inſerted into the third bone of the thumb. This extends the thumb more toward the ulna than the former muſcle, and is very much a ſupinator. **nodii pollicis.**

Flexor primi et ſecundi oſſis pollicis. Flexor primi et ſecundi oſſis pollicis ariſes from the fifth bone and tranſverſe ligament of the carpus, and from the beginnings of the two firſt metacarpal bones, and is inſerted into the whole length of the firſt bone of the thumb, and tendinous into the beginning of the ſecond; the ſeſamoid bones of the thumb in ſuch bodies as have them, lie in this tendon, where it paſſes over the joint.

Flexor tertii internodii pollicis. Flexor tertii internodii pollicis ariſes large from almoſt all the upper part of the radius, and becoming a round tendon, paſſes under the ligamentum tranſverſale carpi to be inſerted into the third bone of the thumb. This muſcle ſingly acting, draws the thumb towards the metacarpal bone of the little finger; but the laſt mentioned muſcle acting with it, turns it toward the fore-finger.

Adductor pollicis. Adductor pollicis ariſes from the carpus, and almoſt the whole length of the metacarpal bone of the middle-finger, and is inſerted into the beginning of the ſecond bone of the thumb. This muſcle naturally enough divides into two, and might better be called a flexor than an adductor.

Abductor pollicis. Abductor pollicis ariſes from the fifth bone and ligamentum tranſverſale of the carpus, and is inſerted laterally into the beginning of the ſecond bone of the thumb to draw it toward the radius.

The muſcles which bend the thumb are much leſs than thoſe which bend the fingers;

nevertheleſs, the thumb is able to reſiſt all the fingers merely from the advantages that ariſe from the thickneſs and ſhortneſs of the bones of the thumb, compared with thoſe of the fingers: but then the quickneſs of motion in the fingers will exceed that of the thumb, as much as the fingers exceed the thumb in length, and their muſcles thoſe of the thumb in largeneſs.

As the major part of this deſcription of the muſcles of the hand and fingers is extracted from other authors, I think it neceſſary here to obſerve, wherever I have taken that freedom (in the courſe of this work) I have uſed their own words, though the author's name may not be mentioned.

SECT. V.

Of the ARTERIES, VEINS, NERVES, and GLANDS of the ARM, &c.

Arteries of the arm, &c.

THE arteries of the arm, &c. proceed all from the ſubclavian: before the ſubclavian leaves the thorax it gives off various branches, diſtinguiſhed by the names of the parts they are beſtowed on already mentioned in Chap. iv. Sect 6. From the arteriæ thoracicæ a branch in particular runs down between the detoides and pectoralis, together with the vena cephalica, to which it adheres very cloſely, as if there were an anaſtomoſis between them. Another branch ſometimes runs between the muſculus brachiæus and anconæus internus, which communicates with a branch of the radial artery.

The

Arteriæ axillares.

The ſubclavian artery having left the thorax immediately above the firſt rib, in the interſtice left between the portions of the ſcalenus muſcle, it gives off the arteries above mentioned, and the external ſcapulary as underneath, and then receives the name of axillaris, becauſe it paſſes under the axilla.

Arteriæ ſcapulares.

The external ſcapulary artery paſſes thro' the notch in the ſuperior coſta of the ſcapula, to the muſculus ſupra-ſpinatus and infra-ſpinatus, teres major and minor, and to the articulation of the ſcapula, with the os humeri. The internal ſcapularis ariſes from the axillary artery near the axilla, and runs backward, to be diſtributed to the ſubſcapularis, giving branches and ramifications to the ſerratus major, axillary glands, teres major, infra-ſpinatus and upper portion of the anconæi.

Arteria humeralis.

Arteria humeralis ariſes from the lower and fore-ſide of the axillaris, and runs backward between the head of the os humeri and teres major, ſurrounding the articulation till it reaches the poſterior part of the deltoides to which it is diſtributed. During this courſe it gives ſeveral branches to the ſuperior portions of the anconæi, to the capſular ligament of the joint of the ſhoulder, and to the os humeri itſelf, through ſeveral holes immediately below the great tuberoſity of the head of that bone, communicating with the ſcapulary artery. Oppoſite to the origin of this artery, the axillaris ſends off a ſmall branch in a contrary direction between the head of the os humeri and the upper part of the biceps and coraco-brachialis, which goes to the vagina and channel of the biceps, and to the perioſteum and afterwards joins the humeralis.

Arteria brachialis.

The axillary artery having given off theſe branches paſſes immediately behind the tendon of the pectoralis, where it changes its former name for that of the arteria brachialis. It runs down on the inſide of the arm over the muſculus coraco-brachialis, and triceps extenſor cubiti, and along the inner edge of the biceps behind the vena baſilica, giving ſmall branches on both ſides to the neighbouring muſcles, to the perioſteum, and to the bone. Between the axilla and middle of the arm, it is covered only by the ſkin and fat; but afterwards it is hid under the biceps, and runs obliquely forward as it deſcends; but it does not reach the middle of the fold of the arm. In its paſſage to this place it ſends off many branches to the infraſpinatus, teres major, and minor, ſubſcapularis, latiſſimus dorſi, ſerratus major, and other neighbouring muſcles, to the common integuments and even to the nerves. Below the fold of the arm it divides into two principal branches, mentioned below, one called arteria cubitalis, the other radialis. From the upper and inner part, the arteria brachialis ſends off a particular branch, which runs obliquely downward and backward over the anconæus, and then turns forward again near the external condyle, where it communicates with a branch of the radialis. Immediately below the inſertion of the teres major, it gives off another branch which runs round the os humeri, and deſcends obliquely forward between the muſculus brachiæus and triceps extenſor cubiti, to both which it is diſtributed in its paſſage. Having afterwards reached the external condyle, it unites with the branch laſt mentioned and alſo communicates with thoſe of the fore-arm, ſo that here is a triple anaſtomoſis. About the breadth of a finger below this ſecond branch, the brachial artery ſends off a third, down toward the internal condyle, which alſo communicates with thoſe of the fore-arm, as obſerved hereafter. Near the middle of the arm it ſends off a branch between the brachiæus and the triceps to the perioſteum which penetrates the bone. About an inch lower, it gives off a branch, which ſends ramifications to the triceps, and runs over the inner condyle communicating with branches of the fore-arm. Below the middle of the arm another branch of the brachialis runs behind the inner condyle in company with a conſiderable nerve; and having paſſed over the muſcles inſerted in this condyle it communicates with that branch of the cubital artery, which encompaſſes the fold of the arm. A little lower, another branch is ſometimes detached on the fore ſide of the inner condyle, which communicates with a branch of the cubital artery. Theſe three communicating branches are termed collateral arteries.

The common trunk of the brachial artery having reached the fold of the arm, runs together with a vein and a nerve immediately under the aponeuroſis of the biceps, and paſſes under the vena mediana, detaching branches on each ſide to the neighbouring muſcles. About an inch beyond the fold of the arm, the brachial artery divides into two principal branches, one inner or poſterior, named cubitalis; the other outer or anterior, named radialis, as has been already ſaid. From this bifurcation, the brachial artery ſends branches on each ſide to the ſupinator and pronator muſcles, teres, fat, and ſkin.

Arteria cubitalis.

The cubital artery ſinks in between the ulna and the upper parts of the pronator teres, perforatus, palmaris longus, and flexor carpi radialis; then leaving the bone, it runs down between the perforatus and palmaris longus, all the way to the carpus and great tranſverſe ligament. In this courſe it winds and turns ſeveral ways, and ſends out ſeveral branches; very often there is a branch of communication between the brachial and cubital arteries. This communicant branch is ſometimes very large, and liable to be pricked by careleſs or injudicious blood-letters in bleeding in the baſilic vein, immediately under which this branch generally lies. Mr. Monro has found the ſuclavian artery divided in one ſubject into two, the exterior of which formed the radialis, and the inner the cubitalis; from which ſtructure he accounts for the ſucceſs in the operation of the aneuriſm ſometimes performed above the cubit. When the operation for an aneuriſm is made upon the communicant branch, it is found neceſſary to tie it on both ſides of the orifice, becauſe the blood is liable to flow freely into it either way.

The firſt branch of the cubital is a ſmall artery which runs inward to the inner condyle, and then turns up and communicates with the collateral arteries above mentioned. Another ſmall branch goes off a little lower down which runs upward a little way, and almoſt ſurrounds the articulation, communicating with the ſecond collateral artery be-

between the olecranon and inner condyle. The cubital artery running then between the heads of the ulna and radius, and having reached the interoſſeous ligament, ſends off two principal branches which may be called interoſſeous arteries of the fore-arm, one internal, the other external. The external pierces the ligament about three fingers breadth below the articulation, from which runs up a branch to the external condyle of the os humeri under the extenſor ulnaris and anconæus, to which it is diſtributed, as alſo to the ſupinator brevis; it communicates with the collateral arteries on the ſame ſide. Afterwards this external interoſſeous runs down on the outſide of the ligament, and is diſtributed to the extenſor ulnaris, extenſor digitorum communis, and to the extenſores pollicis, indicis, and minimi digiti; communicating with branches of the internal interoſſeous. At the lower extremity of the ulna it unites with a branch of the internal interoſſeous, and is diſtributed together with it on the back of the hand, communicating with the radialis and a branch of the cubitalis. By theſe communications this artery forms a ſort of irregular arch, from whence branches are detached to the external interoſſeous muſcles, and to the external lateral parts of the fingers. The internal interoſſeous artery runs down very cloſe to the ligament, which it perforates between the pronator teres and pronator quadratus, and goes to the back of the hand, where it communicates with the external interoſſeous, radialis, and the internal branches of the cubitalis. From the origin of the two arteriæ interoſſeæ, the cubitalis runs down between

tween the perforatus, perforans, and flexor carpi ulnaris, along the ulna, ſending branches to the neighbouring parts. Afterward the cubital artery paſſes over the internal tranſverſe ligament of the carpus by the ſide of the os piſſiforme vel orbiculare, and having furniſhed the ſkin, palmaris brevis, and metacarpus, it ſlips under the aponeuroſis palmaris, giving off a branch to the abductor minimi digiti, and another towards the thumb between the tendons of the flexors of the fingers and the baſes of the metacarpal bones. A branch runs alſo between the third and fourth bones of the metacarpus to the back of the hand, where it communicates with the external interoſſeous artery. Afterwards, having ſupplied the interoſſeous muſcles, it communicates with the radialis, and they both form an arterial arch in the hollow of the hand in the following manner: about two fingers breadth beyond the internal annular ligament of the carpus, the cubitalis forms an arch, the convex ſide of which is turned to the fingers, and commonly ſends off three or four branches; the firſt to the inner and back part of the little finger; and the other three run in the interſtices of the four metacarpal bones, near the heads of which, each of them is divided into two branches, which run on each ſide the fingers internally, and at the ends of the fingers theſe digital arteries communicate and unite with each other. From the concave ſide of this arch towards the ſecond phalanx of the thumb, a branch goes to the internal lateral part thereof, and then ends near the head of the firſt metacarpal bone, by a communication with the radialis;

having firſt given a branch to the foreſide of the index, and another to the ſide of the thumb; theſe communicate as the other digital arteries. This arch ſends likewiſe ſmall twigs to the interoſſeous muſcles, lumbricales, palmaris, and other neighbouring parts; and laſtly to the integuments.

Arteria radialis.

The radial artery begins by detaching a ſmall branch upward toward the fold of the arm, which alſo turns backward round the external condyle, communicating with the neighbouring branches of the brachial artery. The radial artery runs down on the inſide of the radius, between the ſupinator longus, pronator teres, and the integuments, giving branches to theſe muſcles, and likewiſe to the perforatus, perforans, and ſupinator brevis. From thence it runs in a winding courſe toward the extremity of the radius, ſupplying the flexors of the thumb and pronator quadratus. Having reached the extremity of the radius, it runs nearer the ſkin, eſpecially toward the anterior edge of the bone, being the artery which we there feel when we examine the pulſe. At the end of the radius it gives off a branch to the abductor pollicis; and after communicating with the arch in the palm of the hand above mentioned, and ſending off ſome cutaneous branches at that place, it detaches one to the whole internal ſide of the thumb. Afterwards it runs between the firſt phalanx and tendons of the thumb, to the interſtice between it and the firſt metacarpal bone, where it turns toward the hollow of the hand, and ſends off a branch to the external ſide of the thumb communicating at the end thereof by a ſmall arch with the branch of the internal ſide of the thumb. Other branches of the radialis run tranſverſely outward between the firſt two bones of the metacarpus and the two tendons of the extenſores carpi radiales; they communicate with the cubitalis, and together furniſhes the external interoſſeous muſcles and integuments of the back of the hand. Laſtly, the radialis terminates in its paſſage over the ſemi-interoſſeous muſcle of the index, near the baſis of the firſt metacarpal bone, and runs under the tendons of the flexor muſcles of the fingers, where it is joined to the arch of the cubitalis. It ſends off another branch along the fore-part of the firſt bone of the metacarpus to the back of the index, where it is loſt in the integuments; it gives alſo a branch to the internal ſide of the index, and at the end of the finger joins an oppoſite branch which comes from the arch of the cubitalis. Another ſmall branch croſſes the internal interoſſeous muſcles, and communicates with the great arch. When the arch of the cubitalis ends at the middle-finger, the radialis runs along the inner part of the firſt metacarpal bone, at the head of which it terminates by two branches; one runs along the inner ſide of the index, and the other paſſes between the flexor tendons of this finger and the metacarpal bone, and having communicated with the cubital branch of the middle finger, it advances on the poſterior lateral part of the index to the end of the finger, where it unites again with the firſt branch.

Veins of the arm, &c. The veins of the arm, &c. likewiſe proceed from the ſubclavian, and the various branches are diſtinguiſhed by the names of the parts they are beſtowed on, in the ſame manner as the arteries already mentioned.

Vena axillaris. The ſubclavian vein having ſent off the branches already deſcribed, goes out of the thorax, and paſſes before the anterior portion of the muſculus ſcalenus, and between the firſt rib and the clavicle to the axilla. Through this courſe it takes the name of vena axillaris, and gives off ſeveral branches, the chief of which are the venæ muſculares, thoracicæ and vena cephalica, which is ſometimes double. The firſt veins which it ſends off are the muſculares, diſtributed to the middle portion of the muſculus trapezius, to the angularis, infra-ſpinatus, and ſubſcapularis; and as ſome of theſe branches go to the ſhoulder exteriorly, others interiorly, the venæ ſcapulares are diſtinguiſhed into external and internal. A little before the axillaris reaches the axilla, it ſends out the venæ thoracicæ, one ſuperior called alſo mammaria externa, and the other inferior. It likewiſe ſends branches to the muſculus ſubſcapularis, teres major, teres minor, ſupra ſpinatus, latiſſimus dorſi, ſerratus major, pectoralis, and to the glands of the axilla.

Vena cephalica. The axillaris having reached the ſide of the head of the os humeri, produces a very conſiderable branch named vena cephalica, and afterwards runs along the arm by the name of vena baſilica; however, the baſilica ſometimes appears to be rather a branch than a continuation of the axillary trunk; in which caſe the cephalica and baſilica might be looked upon as two principal branches of the axillaris. The cephalic vein, which is a branch of the axillaris, at a ſmall diſtance from its origin, joins the ſmall cephalica from the ſubclavia or jugularis externa; having till then run near the ſurface of the body between the deltoides and pectoralis. The great cephalica runs down between the tendons of the laſt mentioned muſcles, and along the external edge of the biceps; communicating ſeveral times with the baſilica and is ramified on each ſide, on the neighbouring muſcles, fat, and ſkin. A little below the external condyle of the os humeri, it detaches a branch backward, which runs up between the muſculus brachialis and the upper portion of the ſupinator longus, and afterwards bends back between the os humeri and triceps extenſor cubiti, where it communicates with ſome branches of the baſilica. Near the fold of the arm it is divided into principal branches, one long, the other ſhort. The long branch is named radialis externa, and the ſhort one may be called mediana cephalica, to diſtinguiſh it from another mediana, which is a ſhort branch of the baſilica, and therefore ought to be called vena mediana baſilica. The external radial vein runs along the radius between the muſcles and integuments, and gives off branches to both ſides, which communicate with other branches of the ſame vein and with ſome from the baſilica, forming areolæ much in the ſame manner as the ſaphena.

The mediana cephalica runs down obliquely toward the middle of the fold of the arm, under the integuments, and over the tendon of the biceps, where it joins the mediana baſilica above mentioned. Theſe two medianæ unite in an angle, the apex of which is turned downward. From this angle goes out a conſiderable branch down the fore-arm, uniting on one ſide with the vena cephalica, and communicating on the other with the baſilica, by ſeveral irregular areolæ.

The name of mediana is given to this large branch as well as to the two ſhort ones, by the union of which it is formed; this large branch is the true mediana of Riolan, and that name only ſufficiently diſtinguiſhes it, as the others are alſo termed cephalica and baſilica. From this union of the two lateral medianæ, and ſometimes from the origin of the true mediana, a branch goes down the inſide of the fore-arm, oppoſite to the interoſſeous ligament, and is called vena cubiti profunda. It goes to the neighbouring muſcles, and communicates with the other veins of the fore-arm. The mediana cephalica ſometimes ſends down a long branch, called radialis interna, almoſt parallel to the externa; afterwards, having reached the extremity of the radius, it is diſtributed by numerous areolæ, almoſt in the ſame courſe with the radial artery; a particular branch goes out from it, which runs ſuperficially between the thumb and metacarpus, by the name of cephalica pollicis. The areolæ furniſh the interoſſeous muſcles and integuments, and communicate with a ſmall branch from the baſilica, called by the ancients ſalvatella.

Vena baſilica.

The baſilic vein has ſometimes a double origin, by a branch of communication with the trunk of the axillaris.

Firſt of all, it ſends off under the head of the os humeri a pretty large branch, which paſſes almoſt tranſverſely round the neck of that bone, and running upon the ſcapula it is ramified on the deltoides, and communicates with the venæ ſcapulares externæ. This branch may be named vena ſub-humeralis or articularis as the artery. This articular vein ſends down two principal branches, one on the inſide of the bone, to which and the perioſteum it gives ſmall veins; the other turns forward, toward the middle of the arm between the bone and the biceps, and communicates with the cephalica. Below the neck of the os humeri, near the hollow of the axilla, and behind the tendon of the pectoralis, the baſilica ſends out a conſiderable branch down the ſide of the brachial artery which furniſhes the neighbouring muſcles on both ſides. This vein may be named profunda brachii. Immediately afterwards, the baſilica detaches two or three ſmall veins, very cloſely joined to the brachial artery, which might be named venæ ſatellites arteriæ brachialis: but theſe ſmall veins which often ariſe from the profunda brachii, communicate with the baſilica and cephalica, and at the fold of the arm divide like the artery, having the ſame diviſions along the whole fore-arm. Afterwards, the baſilica continues its courſe along the inſide of the os humeri, between the muſcles and integuments, which it ſupplies, forming many communications with the profunda, ſatellites, and cephalica. Having reached the inner condyle, and ſent off obliquely in the fold of the arm, the mediana baſilica, it runs along the ulna between the integuments and muſcles, a little toward the outſide, by the name of cubitalis externa, ſtill communicating with the profunda, ſatellites, and cephalica. Having detached the mediana baſilica, it ſends out another branch down the inſide of the fore-arm near the ulna, communicating with the true mediana, &c. This branch may be named cubitalis interna. The baſilica having reached the extremity of the ulna, ſends ſeveral branches to the back ſide of the carpus, one of which named ſalvatella, goes to the ſide of the little-finger next the ring-finger, having firſt communicated with the cephalica, by means of the venal areolæ conſpicuous on the back of the hand. In the other fingers this vein follows nearly the ſame courſe with the artery.

The nerves of the arm, &c come originally from the medulla ſpinalis, and proceed immediately from the cervical nerves. Nerves of the arm, &c.

The conſiderable branches into which the nerves of the arm are divided are ſix; theſe Mr. Monro gives the following diſtinguiſhing names to, by which (as he obſerves) the deſcription will be leſs confuſed, and the young anatomiſt's memory better aſſiſted to retain what is ſo difficult to repreſent in words.

1. Cutaneus runs down the fore-part of the arm, and ſerves the teguments as far as the palm of the hand and fingers. Cutaneus.

2. Muſculo-cutaneus, or perforans coſſerii, paſſes through the muſculus coraco-brachialis, and after ſupplying the biceps and brachiæus internus, is ſpent on the teguments of the back of the cubitus and hand. Muſculo-cutaneus.

3. Muſcularis runs down the fore-part of the arm to be loſt in the muſculi flexores, carpi, digitorum, &c. Muſcularis.

4. Ulnaris, which ſupplies the extenſores cubiti, and teguments of the elbow, and then Ulnaris.

then paſſing through the ſinuoſity at the back of the external condyle of the humerus, runs along the ulna, where it gives twigs to the teguments and neighbouring muſcles; at length it is loſt in the back of the hand, muſculi interoſſei, and lumbricales in the little-finger, and ſide of the ring-finger next to this. The courſe of this nerve is ſufficiently felt when we lean on our elbow, by the inſenſibility and prickling pain in the parts to which it is diſtributed.

Radialis. 5. Radialis goes down the fore-part of the arm, near the radius, beſtowing branches in its progreſs on the circumjacent muſcles, and ſplitting at the ligamentum annulare carpi it is ſent to the thumb, fore-finger, middle-finger, and half of the ring-finger, and to the back of the hand.

Articularis. 6. Articularis runs almoſt round the top of the os humeri, and ſerves the muſculi extenſores cubiti, retractores, and elevatores humeri. By a ſtrong and continued preſſure on theſe nerves, by crutches, or any ſuch hard ſubſtance, a palſy and atrophy of the arm may be occaſioned.

Glands of the arm, &c. The axillary glands are ſituated under the arm-pits, enveloped in fat, and lie cloſe by the axillary veſſels. About the ſcapula, and the flexure of the elbow, there are alſo found here and there ſome ſmall glands; as alſo in ſome places between and among the muſcles: but as their number and ſituation, as well as their ſize and figure, are very uncertain and variable, it is not neceſſary to recount them here.

Cutaneous glands. As to the cutaneous glands already curſorily mentioned in the introduction, Verheyen tells us, that Steno had diſcovered that there is a gland ſituated under every diſtinct pore of the ſkin, from whence there ariſes a veſſel for the conveyance of the matter of ſweat, which terminates at the ſurface of the cutis, and hence calls them ſubcutaneous glands. The pores of the ſkin are ſo extremely numerous, that if, according to theſe authors, there were a gland belonging to every one of them, the glands muſt be almoſt infinite in number. But in diſſection, when the cutis has been carefully cleared from the fat that is under it, it is certain no ſuch glands are ſeen, either in the ſeparated fat, or on the lower ſurface of the cutis: there are indeed always found little portions of the fat here and there inſinuating themſelves into the little foveolæ, or holes in the cutis; but pieces of fat are eaſily diſtinguiſhed from glands by an expert anatomiſt. From this, and from innumerable ſearches after theſe glands, it appears, that there are indeed no ſuch glands as thoſe called ſubcutaneous.

CHAP. VII.

SECT. I.

Of the LEG and its PARTS.

Leg and its parts.

UNDER the general denomination of the leg and its parts, I ſhall deſcribe all the lower extremities, which are divided, as thoſe of the ſkeleton, into the thigh, leg, and foot: ſee the table of oſteology. The crus extends from nates, or the buttocks, to the ends of the toes; and is divided into femur the thigh, from the iſchinm or hip to the knee; the fold between the belly and thigh is termed inguen, the groin; the top or fore-part of the knee is termed patella, or rotula, the pan of the knee; the hinder part, poples, the ham. From the knee to the inſtep is properly called the tibia or leg, the fore-part of which is crea, the ſhin; the hinder part ſura, the calf; the outward protuberance at the lower end is termed malleolus externus; the outer ancle, on the oppoſite ſide is malleolus internus, or inner ancle. The foot is ſubdivided into three parts, viz. the tarſus, metatarſus, and toes; behind is calcaneus, the heel, before is tarſus, the inſtep; from thence to the toes is the metatarſus; the top of the foot is termed dorſum pedis; the under part or ſole, planta pedis; and the toes digiti pedis.

SECT. II.

Of the BONES of the LEG, &c.

Bones of the leg, &c.

AS under this denomination I comprehend the whole lower limb (as above mentioned) I ſhall begin this ſection with a deſcription of the os femoris, or thigh-bone.

Os femoris.

The os femoris is the longeſt and ſtrongeſt bone of the whole human frame. In its upper extremity is to be obſerved a very large round head, and in this head, a cavity is deſtined for the ligamentum rotundum, by means of which it is fixed in the acetabulum or ſocket of the os innominatum, and its luxation upwards prevented. There are two proceſſes or apophyſes near the head, called the greater and leſſer trochanters, which are evidently formed for the inſertion of muſcles. The neck of this bone lies between the trochanters and the head, to which is affixed a robuſt, annular ligament, which contains the head and neck of the bone, as it were in a caſe. The neck is not ſtrait but oblique, nearly horizontal, and turning ſomewhat outward, ſo formed for keeping the thighs aſunder, by which means we tread the firmer; and by this ſituation room is made for that neceſſary quantity of muſcles which are ſeated on the inſide of the thigh, and alſo by projecting outwards, there are longer levers for the muſcles, which are inſerted into its upper and external parts. Next may be remarked the ſpongy cavernous ſtructure of this extremity of the bone, which renders it leſs liable to fractures, eſpecially in this part: the apertures for the ingreſs of ſeveral veſſels are alſo obſervable, as is the large ſinus between the great trochanter and the neck, into which muſcles are inſerted, and between the two trochanters is a remarkable roughneſs for the ſame uſe, from which begins the linea aſpera. The middle of the thigh-bone, for the conveniency of the muſcles, is a little convex forwards, and ſomewhat concave backwards, which would make it ſubject to break backwards, if there was not a ſtrong ridge on the back-ſide (termed linea aſpera) which ſtrengthens it ſufficiently, and ſerves alſo for advantageous inſertions for ſeveral muſcles. The great cavity of this bone is alſo remarkable for containing the marrow. At the lower end of this bone are two large heads, with a cavity between them, for the articulation with the tibia; alſo a poſterior cavity which gives paſſage for the large veſſels to deſcend ſecurely to the leg. There is, beſides, an interior cavity, for the placing of the patella: and laſtly, two condyles, or tubercles, placed near the heads, and ſerving for a fixed point to the origin of the muſcles which move the foot. In the exterior part of theſe we obſerve a peculiar depreſſion, and often a ſingle ſeſamoide bone; and ſometimes there is alſo found another of theſe in the other tubercle: this uſually, however, happens in old ſubjects. The lower heads of the os femoris are ſo contrived, partly from being projected backwards, and partly from their ſhapes, as to remôve the center of motion very far behind the axis of the bone, which gives great power to the muſcles that extend this joint to raiſe the whole weight of the body, though it leſſens the power of the benders which move the leg only. The ſtrength and firmneſs of this bone are ſurpriſingly great; hence the uſe of the thigh-bone is to ſupport and ſuſtain the weight of the whole body, and its moveable articulation at the head gives way to the eaſy motion of the body, while the feet are unmoved.

Patella. Patella is a bone which covers the fore-part of the joint of the knee, called alſo rotula, and vulgarly the knee-pan, or pan-bone of the knee. It is convex on the outſide, and on the inſide unequal, having an eminence and two depreſſions. Its ſubſtance is ſpongeous, and conſequently, it is brittle. It is connected by tendons and ligaments to the tibia and os femoris, which is the ligament by which it is connected to the thigh, and has a motion of aſcent and deſcent in the flexion of the tibia. Its uſe is to ſecure the extenſors of the tibia, left paſſing over the joint, they might be too much expoſed to external injuries; it alſo increaſes the advantages (mentioned in the laſt paragraph) of removing the common axis of the extenſors of the tibia farther from the centre of motion, and is a moſt convenient medium for thoſe muſcles to unite in, to perform one common action.

The part ſituated from the knee to the ancle is properly called the leg, and conſiſts of two bones, beſides the patella abovementioned, viz. the tibia and the fibula.

Tibia. Tibia is the bigger bone of the leg, (ſo called, from its reſemblance to an old muſical pipe, or flute,) ſituated, at its anterior internal part, and continued in near a ſtrait line, from the thigh-bone to the inner ancle; it is hard and firm, with a cavity in its middle; it is almoſt triangular: its fore and ſharp edge is called the ſhin. This bone is large at its upper end, and has two ſinuſes, or ſockets, which receive the two protuberances or lower heads of the thigh-bone; and the production, or proceſs, which is between the ſinuſes of the tibia is received in the ſinus, or cavity, which divides the two protuberances of the femur beforementioned, and to this rough proceſs of the tibia the croſs ligaments of this joint are connected. One ſide of the upper end has a ſmall proceſs, which is received into a ſmall ſinus of the fibula; and on the fore-part, a little below the patella, is another proceſs, into which the ligament, or tendon of the patella is inſerted, and the tendons of the extenſors of the leg. Its lower extremity, which is much ſmaller than its upper, has a remarkable proceſs, which forms the inner ancle, and ſecures this bone from diſlocating outwards; it has alſo a pretty large ſinus, which receives the convex head of the aſtragalus, and the protuberance is received into the ſinus, in the convex head of the ſame bone. It has another ſhallow ſinus in the ſide of its lower end, which receives the fibula. The upper-end of this bone is triangular as before obſerved, and even concave on the ſide next the muſcles, to make room for them; but lower, as the muſcles grow leſs and tendinous, the bone grows rounder.

Fibula. Fibula is the outer and ſmaller bone of the leg, called alſo perone. It lies on the outſide of the tibia, and its upper end does not reach to the knee, but is only joined to the ex-

external ſide of the tibia, receiving the ſmall lateral proceſs of the upper end of that bone into a ſmall ſinus, which the fibula has in its inner ſide. The lower end of this bone is received into the ſmall ſinus of the tibia, and then it extends into a large proceſs, which forms the outward ancle, embracing the external ſide of the aſtragalus. Thus the inferior proceſſes of the tibia and fibula concur in the articulation of the tarſus, which ſerves to ſtrengthen the ancle joint, and render a luxation leſs eaſy. The tibia and fibula do not touch one another but at their ends; the ſpace which they leave in the middle is filled up by a ſtrong membranous ligament, and ſome muſcles, which extend the feet and toes. The fibula has no particular motion of its own, but wholly follows that of the tibia; and it ſeems doubtful, whether or not this bone contributes to the ſupport of the body: its great uſe is for the origins of muſcles, and even its ſhape is ſuited to theirs.

The bones of the foot are thoſe of the tarſus, metatarſus, and toes.

Tarſus. Tarſus is the ſpace between the bones of the leg and the metatarſus, conſiſting of ſeven bones, viz. the aſtragalus, or talus, calcaneum, or os calcis, os naviculare, os cuboides, vel cubiforme, and the three oſſa cuneiformia. The firſt of theſe bones, which is the aſtragalus, ſupports the tibia, and is ſupported by the os calcis, which being projected backwards, makes a long lever for the muſcles to act with, that extend the ancle and raiſe the body upon the toes. Theſe two bones have a conſiderable motion between themſelves, and the aſtragalus alſo with the os naviculare, and all the reſt an ob-

obſcure motion one with another, and with the bones of the metatarſus; the greateſt part of theſe motions being towards the great toe, where is the greateſt ſtreſs of action. Theſe bones thus giving way are leſs liable to be broke, and, as a ſpring under the leg, make the motions of the body, in walking, more eaſy and graceful, and the bones which are ſupported by them leſs ſubject to be fractured in violent actions.

Metatarſus. Metatarſus is the ſpace between the tarſus and toes, conſiſting of five bones, articulated to the tarſus at one end, and to the toes at the other; the metatarſal bone which ſupports the great toe is much the largeſt, the greateſt ſtreſs in walking falling upon that part; under the end of this lie the two ſeſamoid bones, which are of the ſame uſe as the patella.

Digiti pedis, or toes. Digiti pedis is a term given by anatomiſts to the toes, being the extreme diviſions of the feet, anſwering to the fingers of the hand, and are five on each foot. Each of the toes, except the great one, conſiſts of three phalanges; the great toe has but two, and the two laſt of the little toe frequently grow together. The bones of the toes are much ſlenderer, except that of the great toe, than thoſe of the fingers; and they have alſo a much leſs free motion than thoſe of the fingers.

SECT. III.

Of the CARTILAGES, LIGAMENTS, &c. of the LEG, &c.

Cartilages of the os femoris.

NO part of the os femoris is covered with a cartilage, except the uniform convexity of its head, and the articular portion of the lower extremity: the trochanters in adults have no true cartilage. The convexity of the head of the os femoris all the way to its ſymphyſis with the neck, is covered by a very ſmooth ſhining cartilage, extending further on the fore and back-ſides, than on the other ſides. The cartilage which covers the lower extremity of this bone, is exactly fitted to the ſemi-oval convexity of the inferior ſurface of each condyle, and to the pulley formed by their union. In the poſterior part of the lateral tuberoſity of each condyle, there is another kind of cartilaginous ſurface.

Cartilage of the patella.

The patella has a pretty thick cartilage on its poſterior or articular ſide, divided by a ſuperficial longitudinal riſing into two parts, proportioned to the two portions of the pulley of the os femoris before mentioned.

Cartilages of the tibia.

The tibia has four or five proper cartilages, and two additional ones. The two proper cartilages which cover the two ſuperior ſurfaces of the head of the tibia are the thickeſt, and both gently hollow; anteriorly they join each other: the third proper cartilage covers the ſmall ſurface which lies on the lower part of the external condyle; and the fourth covers the lower ſurface of the baſis of the tibia, being continued over the outſide of the inner ancle: there are likewiſe ſuperficial cartilaginous incruſtations on the back part of both ancles for the paſſage of tendons.

The additional cartilages of the tibia are two in number, called ſemilunar or interarticular; each of theſe cartilages is in the ſhape of a C; their convexity is very thick, but their concavity very thin: they lie on the two upper ſurfaces of the head of the tibia; their thickeſt part anſwering to the edges of the head, and their thin edges to the middle of each ſurface, their extremities or cornua being turned toward each other, ſo that one third of the tibia is bare in the middle. Theſe, with the middle portions of the ſurfaces of the head of the tibia, form cavities proportionable to the convexity of the condyles of the os femoris.

Cartilages of the fibula.

The fibula has two cartilages, one lying on the upper extremity of that bone, for its articulation with the ſmall cartilaginous ſurface in the head of the tibia; the other cartilage covers the inſide of the inferior extremity, or of the outer ancle.

Cartilages of the bones of the foot.

The aſtragalus is covered by three cartilages; the firſt of theſe is for the articulation of this bone with the tibia and fibula; the ſecond for the os calcis; and the third for the os ſcaphoides vel naviculare. The os calcis has four cartilages, of which three are ſuperior, one large, and two ſmall for its triple articulation with the aſtragalus; the fourth is anterior, for the os cuboides. The os naviculare has two cartilages, one poſterior for its articulation with the aſtragalus; and one anterior, divided into three parts for the three oſſa cuneiformia. The os cuboides has two remarkable cartilages, one poſterior for its articulation with the os calcis, and one anterior, lying in two planes for its articulation with the two laſt metacarpal bones: it has likewiſe a cartilage on the inſide for the os cuneiforme which is next to it, and one on the lower ſide. The three oſſa cuneiformia have each of them a poſterior cartilage for their articulation with the os naviculare; and one anterior, for the three firſt metacarpal bones; they have likewiſe ſmall cartilaginous ſurfaces on their ſides, for their articulations with each other; and beſides, the firſt and third bones are joined thereby to the lateral parts of the baſis of the ſecond metatarſal bone, and the third to the os cuboides. The baſes and heads of the metatarſal bones are covered with cartilages. The phalanges have cartilages in the ſame manner at their baſes and heads, except at the heads or extremities of the laſt. We ought to beware of confounding the remains of tendons, ligaments, and aponeuroſes with true cartilages, as for inſtance, at the poſterior part of the os calcis, &c.

Ligaments of the os femoris.

The os femoris is connected by its upper extremity to the os innominatum, and by the lower to the bones of the leg, by means of ſeveral ligaments. The ligaments of the upper extremity are two in number; one ſurrounds the whole articulation thereof, with the cotyloide cavity, or acetabulum, and one is contained in the articulation. To theſe we may, though very improperly, add a third, which is of the nature of a capſular ligament.

The firſt is termed the orbicular ligament of the head of the os femoris, and is the moſt conſiderable, largeſt, and ſtrongeſt of all the articular ligaments of the human body. It is fixed quite round the border of the acetabulum, or cotyloide cavity, in the manner already ſaid; and from thence largely ſurrounds the whole head and ſuperior portion of the neck of the os femoris, in the lower part of which neck it is cloſely inſerted. The other ligament of the head of the os femoris, which lies in the joint, I call internal and inter-articular; it is not round, as its common name would make us believe, but reſembles a flat cord, broad at one end, and narrow at the other, and therefore, in ſome meaſure of a triangular ſhape. By its narrow end, it is inſerted at the two angles of the notch of the cotyloide cavity, and by the other in the os femoris, in the upper part of the ſmall ſemilunar foſſula: this inſertion is oblique, a little rounded on the upper-part, and flat on the lower, and in moſt ſubjects there is a ſort of depreſſion in the head of the bone for the paſſage of the ligament. The ligaments of the lower extremity of the os femoris, by which this bone is connected with thoſe of the leg, are ſix in number, viz. one poſterior, two lateral, two middle, or crucial, and one capſular. The crucial ligaments lie within the joint, and are fixed by one end to the back-part of the notch, or opening, which parts the two condyles. They are ſurrounded by the capſular ligament, but all the reſt lie on the outſide thereof, being cloſely joined to it. The two lateral ligaments are fixed one to each tuberoſity of the condyle's. The poſterior ligament is fixed a little above the convexity of the external condyle, from whence it deſcends obliquely, be-

behind the great notch and internal condyle. The capſular ligament glued, as it were, to the three former, as has been ſaid, is fixed quite round the inferior extremity of the os femoris, juſt above the cartilage, and the poſterior part of the great notch; and from the cartilage and notch, through the ſmall ſpace upward, already mentioned, it covers the bone; and afterwards is inverted downward, to form the capſula for the mucilaginous liquor of the joint. The reſt of the deſcription of all theſe ligaments muſt be referred to that of the bones of the leg.

Ligaments of the patella.

The patella is faſtened to the tuberoſity, or ſpine of the tibia, by a broad and very ſtrong ligament, which runs down directly from the apex of the patella, and is oftentimes further ſtrengthened by ſome fibres of a conſiderable tendon inſerted in the upper part of that bone. It has likewiſe ſmall lateral ligaments, fixed in the lower part of its edge on each ſide, which are inſerted anteriorly, and a little laterally in the edge of the head of the tibia.

The capſular ligament of the joint of the knee, of which I deſcribed one part in ſpeaking of the lower extremity of the os femoris, is fixed round the edge of the head of the tibia, and in the edge of the patella, ſo that the patella itſelf forms a portion of the mucilaginous capſula of the joint of the knee. The crucial ligaments, and thoſe of the ſemilunar cartilages, are included within this capſula; but the lateral and poſterior ligaments, and thoſe of the patella, lie without it, being cloſely joined to its outer ſurface. This capſula is likewiſe joined to a conſiderable portion of the circumference of the ſemilunar cartilages. The inſide of it is ſmooth and ſhining, and it is very thin where it is not covered by tendons, as ſhall be obſerved hereafter. It not only contains and ſurrounds the ligaments already named, but likewiſe furniſhes them with a very fine vagina. There is likewiſe a very thin ligament fixed by one end to the lower part of the cartilaginous ſide of the patella, and by the other to the anterior part of the great notch, between the condyles of the os femoris, the uſe of which ſeems to be to hinder the articular fat from being compreſſed in the motions of the knee.

Ligaments of the tibia.

I have already obſerved, that the tibia is connected with the os femoris by ſeveral ligaments, two lateral, one poſterior, two middle, and one capſular, and I have ſhewn in what manner they are fixed in the lower extremity of the os femoris and patella. Their inſertion in the bones of the leg are as follows. The innermoſt of the two lateral ligaments is fixed pretty low down, on the inner ſide of the ſuperior part of the tibia; it is likewiſe joined to the edge of the internal ſemilunar or inter-articular cartilage. The external lateral ligament is fixed in the upper extremity of both tibia and fibula; and is joined likewiſe to the edge of the external ſemilunar cartilage. Both theſe ligaments lie a little behind the middle of the articulation. The poſterior ligament is fixed, by ſeveral expanſions, in the poſterior part of the head of the tibia. One of the crucial ligaments is fixed by one end to the internal ſuperficial impreſſion in the notch of the os femoris, and, by the other, to the notch in the head, behind the cartilaginous tubercle, which lies between the two ſuperior ſurfaces. The other crucial ligament is fixed by one end to the external impreſſion in the notch of the os femoris, and, by the other, between the anterior portion of the ſurfaces juſt mentioned. The ſemilunar cartilages have likewiſe particular ligaments, beſides their connexions with the lateral ligaments of the tibia; their cornua do, in ſome meaſure, degenerate into ſhort ſtrong ligaments, by which they are faſtened to the cartilaginous tubercle between the two ſuperior ſurfaces of the tibia: they have likewiſe a common ligament, which, like an arch, runs tranſverſely between the anterior convexity of the one to that of the other. Theſe cartilages, therefore, have three ſorts of connexions. They are faſtened to the tibia, by the ligaments of the cornua; to each other by the tranſverſe ligament; and to the os femoris, by their communications with the crucial ligaments, and by their adheſions to the lateral and capſular ligaments.

Ligaments of the fibula.

The fibula is joined to the tibia by nine ligaments, four at each end, and one in the middle, called the interoſſeous ligament. The ligaments at the upper extremity of the fibula are ſhort, very ſtrong, more or leſs oblique and compound; two of them are anterior, two poſterior, and they lie on each other; the ſuperior ligaments ſurrounding the articulation more cloſely than the inferior. They are all glued to the capſular ligament, which runs in between them and the articulation, and they are inſerted round the edges of the cartilaginous ſurfaces in each bone. The ligaments of the lower extremity of the fibula are diſpoſed much after the ſame manner, that is, two before, and two be-

behind; they are fixed to the anterior and poſterior edge of the lateral depreſſion at the inferior extremity of the tibia, and from thence they run down on the lower end of the fibula forming the outer ancle. As the two bones touch each other only by the upper part of the cartilaginous ſurface of the outer ancle, and the ſmall cartilaginous border in the lower edge of the depreſſion of the tibia, the middle ſpace between them is filled by a ſort of capſular ligament, which lines each ſide of the bones, and is continued down to the true articulation of the external ancle, with the inferior edge of the baſis of the tibia. The middle, or interoſſeous, ligament of the two bones of the leg, ſo called becauſe it fills up all the ſpace left between them, being ſtretched from one to the other. It is perforated both above and below, and ſometimes in ſeveral places beſides, for the paſſage of the blood-veſſels and nerves. It is not a ligament deſigned to tie theſe bones together, but rather a ligamentary ſeptum for the inſertion of muſcles, in which reſpect it ſupplies the place of bones; and ſeems partly to be a continuation of the perioſteum of the tibia and fibula. At the lower part of each ancle there are commonly three ſtrong ligaments for the connexion of the bones of the tarſus with thoſe of the leg, one that runs forwards, one backwards, and one more or leſs directly downward. The other ligamentary expanſions and annular ligaments of this part will be mentioned in their proper place, as they do not belong properly to the bones.

Ligaments of the bones of the foot.

The foot being made up of many bones, muſt, beſides thoſe ligaments by which it is tied to the bones of the leg, have ſeveral others to connect not only the three parts of which it is compoſed, but alſo the particular bones belonging to each part. I have already mentioned the inſertions of three ligaments in each ancle for the articulation of the ancles with the foot. The ligaments of the inner ancle are all fixed in the inſide of the aſtragalus. The anterior and middle ligaments of the outer ancle are fixed in the outſide of the aſtragalus; the poſterior is chiefly fixed in the outſide of the os calcis. All theſe ligaments lie on the outſide of the capſula, which ſurrounds the articulation of the aſtragalus with the bones of the leg. The ligaments by which the bones of the tarſus are connected with each other, are ſhort, flat, of different breadths, and run from one bone to another in various directions. They are all ſuperficial, except one, by which the aſtragalus is tied to the os calcis, and for the moſt part are either ſuperior or inferior, the lateral ligaments being but very few in number. Some of them are partly common to ſeveral bones, and partly belong only to two; that is, the ſuperficial ſtrata of their fibres run over one bone into the following, and ſometimes further; but the ſtrata next the articulation are generally confined to two bones only. The capſular ligaments of theſe bones go very little further than the edges of the articulations of one bone with another; they adhere very cloſely to the true ligaments, and are covered and hid by them. The os cuboides and the three oſſa cuneiformia, are alſo connected to the metatarſal bones, by ſeveral particular ligaments. The bones of the metatarſus are connected together by their baſes and heads; the ligaments that go between the baſes are ſuperior and inferior; and thoſe that go between the heads have nealy the ſame general diſpoſition. The inferior ligaments, by filling the ſpaces between the heads, keep them at ſome diſtance from each other. The firſt phalanges of the toes are tied to the heads of the metatarſal bones, by a ſort of orbicular ligament, ſet round the edges of the cartilaginous portions of the head, and thoſe of the baſes of the phalanges. The ſecond and third phalanges of all the toes, being articulated by ginglymi, have lateral ligaments, which go between the ſides of the baſes to the ſides of the heads. At the inferior edges of all theſe baſes, there is a cartilaginous matter joined to the inferior part of the ligaments which hardens with age like a ſeſamoide bone, as do thoſe of the firſt phalanges above mentioned. The capſular ligaments of all theſe articulations are diſpoſed like thoſe of the tarſus already ſpoken of. The annular ligaments and ligamentary vaginæ, found on the ſurface of many of theſe bones, contribute nothing to their connexion, and therefore ſhall be explained in another place.

Mucilaginous glands of the leg, &c.

The mucilaginous glands of the leg, &c. lie in the ſmall ſpaces, depreſſions, and ſuperficial notches near the edges of the cartilages of each joint; they are covered by the capſular ligaments, and more or leſs mixed with a fatty ſubſtance. The glands of the knee, which lie near the edges of the patella, are the moſt conſiderable, being diſpoſed in form of fringes, and ſupported by a great quantity of fatty matter, which makes, in ſome meaſure, one maſs with them, and is contained within the capſular ligament. There are other mucilaginous glands, both above and below the edges of the ſemilunar cartilages; and likewiſe in the ham, ſome whereof ſerve for the joint, the reſt, for the crucial ligaments. Theſe laſt lie in folds formed by the internal membrane of the capſular ligament, which give particular coverings to the crucial ligaments. The mucilaginous glands of the foot anſwer in number and figure to the depreſſions between the cartilaginous edges and ligaments.

SECT. IV.

Of the MUSCLES of the LEG, &c.

Muſcles of the leg, &c.

IT may be neceſſary again to obſerve, that under the denomination of the leg, &c. are comprehended all the lower extremities; therefore I ſhall firſt deſcribe the muſcles of the thigh, then thoſe (properly) of the leg, and afterwards the muſcles of the foot and toes.

Pſoas magnus.

Pſoas magnus is a long, thick muſcle, ſituated in the abdomen, on the lumbar region, adhering to the vertebræ of the loins, from the poſterior part of the os ilium to the anterior part of the thigh. It ariſes laterally from the bodies and tranſverſe proceſſes of the four ſuperior vertebræ of the loins, and the laſt of the back, and is inſerted with the following muſcle into the leſſer trochanter. This is one of the flexor muſcles of the thigh, and when the pſoas parvus is wanting, this is larger.

Iliacus internus.

Iliacus internus ariſes from the internal concave part of the os ilium, and from its lower edge; in its deſcent over the inferior part of the ilium, near the os pubis, it joins with the pſoas magnus, and is inſerted with it, to be employed in the ſame action. Theſe move the thigh forward in walking.

Pectinæus.

Pectinæus is a ſmall, flat, and pretty long muſcle, broad at the upper part, and narrower at the lower, ſituated obliquely between the os pubis and the upper part of the os femoris. It ariſes from the os pubis or pectinis, near the joining of that bone with its fellow, and is inſerted into the linea aſpera of the thigh-bone, four fingers breadth below the leſſer trochanter. This bends the thigh and turns the toes outward.

Triceps femoris.

Triceps femoris is the adductor muſcle of the thigh, having three heads and as many inſertions; the two leſſer heads of this muſcle ariſe under the pectineus, and the third from the inferior edges and back-part of the os pubis and iſchium, and are inſerted into the whole linea aſpera and the inner apophyſis of the os femoris. This alſo bends the the thigh, and turns the toes outward.

Glutæus maximus.

Glutæus maximus ariſes from the os coccygis, the ſpine of the ſacrum, ſpine of the ilium, and from a ſtrong ligament that runs between the ſacrum and the tubercle of the iſchium, and from a thin faſcia ſpread over that part of the following muſcle, which this does not cover; and is inſerted by a ſtrong tendon into the upper part of the linea aſpera of the os femoris, four fingers breadth below the great trochanter. This extends the thigh, and both theſe together being contracted, occaſionally aſſiſt the levatores ani in ſupporting the anus.

Glutæus medius ariſeth from all the anterior part of the ſpine of the ilium, under the former, and is inſerted into the ſuperior and external part of the great trochanter of the os femoris. This extends the thigh outward. Glutæus medius.

Glutæus minimus ariſes from the lower part of the external ſide of the ilium, under the former, and is inſerted into the ſuperior and anterior part of the great trochanter and neck of the thigh-bone, to extend the thigh. Theſe three muſcles form the buttocks. Glutæus minimus.

Pyriformis, vel iliacus externus, ariſes thick from the inſide of the lower part of the os ſacrum, where it is joined to the ilium, from thence it runs tranſverſely towards the joint of the hip, and terminates in more than half its progreſs in a round tendon, which is inſerted into the upper part of the ſinus at the root of the great trochanter. This aſſiſts ſomewhat in extending the thigh, but more in turning it outward. Pyriformis.

Quadratus femoris is ſituated tranſverſely between the tuberoſity of the iſchium and the great trochanter. It ariſes from the obtuſe proceſs of the iſchium, and is inſerted into the upper part of the linea aſpera of the os femoris, between the two trochanters. This draws the thigh inward, and directs the toes outward. Quadratus femoris.

Obturator internus, vel marſupialis, ariſes from the internal circumference of the hole that is between the iſchium and the os pubis, and from the ſtrong membrane or ligament, which fills up the hole; thence paſſing Obturator internus.

ing through the ſinuoſity of the iſchium betwixt its two proceſſes, it receives from them two other portions, which are a ſort of marſupium, and is inſerted into the ſinus of the great trochanter. This turns the thigh outward.

Obturator externus.

Obturator externus ariſes oppoſite to the former, from the external circumference of the ſame hole; and is alſo inſerted into the ſinus of the great trochanter. This alſo turns the thigh outward.

Theſe four laſt mentioned muſcles acting with the extenſors, prevent their turning the toes inward, and in ſtepping forwards are continually acting to turn the toes outwards; for though the toes are placed perpendicular to the front of the body, in taking a long ſtep, theſe muſcles bring them perpendicular to the ſide of the body; and as theſe direct, the ſame extenſors will turn the thigh either outward or backward with their full force.

Faſcia lata.

Faſcia lata, vel abductor faſcialis femoris, called alſo muſculus membranoſus, ariſes from the fore-part of the ſpine of the ilium. Soon after its origin it becomes entirely membranous, and cloſely ſurrounds the muſcles of the thigh; (being firſt joined by a conſiderable detachment from the tendon of the glutæus maximus, and from the linea aſpera of the os femoris) after which it is inſerted in the upper part of the tibia, near the head of the fibula, and from thence ſends out an aponeuroſis almoſt over the whole external muſcles of the tibia, as thoſe of the thigh-bone. About the middle of the leg it grows looſe, and is ſo continued to the top of the foot, being connected there, and at the lower part of the leg, to the annular ligaments which tie down the tendons. When this muſcle acts, the leg and thigh are drawn outwards; it alſo helps to extend the joint of the knee and to elevate both the thigh and leg.

All theſe muſcles above-mentioned ſerve to move the os femoris on the pelvis.

Gracilis. Gracilis ariſes from the os pubis cloſe to the penis, and deſcending by the inſide of the thigh, is inſerted into the inſide of the tibia, near the ſartorius, four or five fingers breadth below the joint of the knee. This muſcle draws the leg and thigh inwards, and helps to bend the knee.

Sartorius. Sartorius is both an abductor and elevator, ſerving to move the legs upwards and forwards, determining them to croſs each other, as taylors ſit with them, whence the name; it ariſes from the internal part of the anterior and ſuperior ſpine of the ilium, and deſcending obliquely is inſerted into the upper and inner part of the tibia, four or five fingers breadth below the joint of the knee. This is the longeſt muſcle in the human body.

Semitendinoſus. Semitendinoſus, vel ſeminervoſus, ariſes from the protuberance of the iſchium, and becoming a round tendon in ſomewhat more than half its progreſs, is inſerted into the upper part of the tibia, near the gracilis and ſartorius. It helps to bend the leg and extend the thigh.

Semimembranoſus. Semimembranoſus is a long thin muſcle, partly tendinous, whence its name, ſituated on the back-ſide of the thigh, a little towards the inſide, being one of the five flexors of the tibia. It ariſes from the obtuſe proceſs of the iſchium a little above the ſeminervoſus; and is inſerted into the upper part of the tibia, but nearer the joint than the former muſcle for the ſame uſe. Before it is inſerted, it ſends off ſometimes an aponeuroſis like that of the biceps. The ſemitendinoſus and ſemimembranoſus make the internal hamſtring.

Biceps tibiæ.

Biceps tibiæ, vel femoris, is a muſcle with two heads; the ſuperior ariſes from the protuberance of the iſchium, in common with the two preceding muſcles; the other from the inferior part of the linea aſpera of the os femoris: both which join together, and are inſerted by one tendon into the ſuperior and external part of the perone or fibula, to bend the leg, and the firſt head alſo extends the thigh. The tendon of this muſcle forms the external hamſtring, when the knee is bent. Beſides the office commonly aſſigned to this muſcle, in bending the tibia together with the ſartorius and membranoſus, and is likewiſe employed in turning the leg, together with the foot and toes, outwards when we ſit down with the knees bended.

Popliteus.

Popliteus is a ſmall muſcle obliquely pyramidal, ſituated under the ham, from whence its name. It ariſes from the outer apophyſis of the os femoris, and thence running obliquely inward, is inſerted into the back-ſide of the head of the tibia. It aſſiſts the flexors, and draws the tibia toward the outer apophyſis of the thigh-bone.

Rectus tibiæ.

Rectus tibiæ, vel cruris, ariſes with a tendon from the upper part of the acetabulum of the os innominatum, and by another tendon from a proceſſus innominatus of the ilium, don, which is a ſort of ligament to this, below its ſpine forward, and is inſerted together with the three following muſcles into the patella. It bends the thigh and extends the tibia.

Vaſtus externus.

Vaſtus externus is a very large fleſhy muſcle, almoſt as long as the os femoris, broad at the extremities, and thick in the middle, lying on the outſide of the thigh. It ariſes from the fore-part of the great trochanter, and ſuperior part of the linea aſpera of the os femoris, and is inſerted into the upper and external part of the patella. This muſcle extends the tibia.

Vaſtus internus.

Vaſtus internus is very like the former, and ſituated in the ſame manner, on the inſide of the os femoris. It ariſes from the inner and lower part of the linea aſpera, and is inſerted into the upper and inner part of the patella, to extend the tibia; and the fibres of this muſcle being oblique, it keeps the patella in its place, the other muſcles lying in the direction of the os femoris, which makes an obtuſe angle with the tibia; they would alone be liable to draw the patella outward. This contrivance is moſt obvious in thoſe whoſe knees bend moſt inward.

Cruræus.

Cruræus ariſes from the fore-part of the thigh-bone between the two trochanters, and lying cloſe upon the bone, it joins its tendon with the three former muſcles, which is inſerted into the patella; the patella being tied down by a ſtrong ligament to the tibia. Theſe three laſt muſcles extend the tibia only, and might very properly be called extenſor tibiæ triceps.

Theſe ten muſcles not only move the leg upon the thigh, but alſo the thigh upon the leg, the popliteus excepted.

Gaſterocnemius. Gaſterocnemius is a pretty thick, broad, and oblong muſcle, which forms a great part of what is called the calf of the leg; the two parts of this muſcle are by ſome diſtinguiſhed as ſeparate muſcles. It ariſes by two ſmall beginnings from the poſterior part of the os femoris behind the lateral tuberoſity of each condyle, which ſoon becoming large bellies, unite, and then forms a flat tendon which joins the following muſcles to be inſerted into the os calcis. Its uſe is to extend the tarſus and bend the knee.

Plantaris. Plantaris has its origin from the interior part of the external condyle of the os femoris, under the outer beginning of the gaſtrocnemius in the ham, and ſoon forming a ſmall tendon, is ſo continued betwixt the foregoing and ſubſequent muſcles, and is inſerted with them. It bends the knee and extends the tarſus. Some anatomiſts derive the tendinous expanſion on the bottom of the foot from the tendon of this muſcle, but I think without any foundation, as the expanſion is often as large when this muſcle is wanting, &c.

Solæus vel gaſterocnemius internus. Solæus, vel gaſtrocnemius internus, ariſes from the upper part of the tibia, and one third of the fibula below the popliteus, and is inſerted with the two foregoing muſcles by a ſtrong tendon into the upper and back-part of the os calcis. This muſcle only extends the tarſus.

Tibialis anticus. Tibialis anticus is ſituated on the fore-ſide of the leg, and is one of the flexor muſcles; It has its origin from the ſuperior and exterior part of the tibia, and is inſerted laterally into the internal os cuneiforme, and the inferior part of the internal metatarſal bone. This bends and turns the tarſus inward.

Tibialis p ſticus.

Tibialis poſticus, or adductor muſcle of the foot, has its origin in the upper part of the tibia between that bone and the fibula, and paſſing between the bones through a perforation in the tranſverſe or interoſſeous ligament, takes other beginnings from the upper and middle part of the tibia, and from the middle of the fibula and the ligament before-mentioned. The tendon of this muſcle paſſes under the inner ancle, and is inſerted into the os naviculare. It extends and turns inward the tarſus.

Peroneus longus.

Peroneus longus ariſes from the external and ſuperior part of the fibula, and its tendon paſſing under the outer ancle, and the muſcles ſituated on the bottom of the foot, is inſerted into the beginning of the metatarſal bone of the great toe, and the os cuneiforme next that bone. This turns the tarſus outward, and directs the force of the other extenſors of the tarſus toward the ball of the great toe.

Peroneus brevis.

Peroneus brevis ariſes from the middle of the fibula, under a part of the former, and growing tendinous, paſſes under the outer ancle, and is inſerted into the beginning of the upper part of the os metatarſi of the little toe, and ſometimes beſtows a ſmall tendon on the little toe. Its uſe is to extend the tarſus and turn it outward.

Theſe two laſt muſcles riding over the lower end of the fibula, are often the cauſe of a ſpaain in the outer ancle, when they are vehemently exerted to ſave a fall.

Theſe ſeven muſcles (which Winſlow divides into nine) ſerve to move the tarſus and foot on the leg.

Extenſor pollicis pedis longus.

Extenſor pollicis pedis longus ariſes from the upper and fore-part of the fibula and the interoſſeous or tranſverſe ligament, and ſoon forming into a ſtrong tendon, is inſerted into the laſt bone of the great toe. This alſo bends the tarſus with a much longer lever than it extends the toe.

Extenſor pollicis pedis brevis.

Extenſor pollicis pedis brevis ariſes from the fore-part of the os calcis, and ſoon becoming a long ſlender tendon, it paſſes obliquely over the upper part of the foot, and is inſerted into the ſame place with the former.

Flexor pollicis pedis longus.

Flexor pollicis pedis longus is an antagoniſt to the extenſor longus, ariſing oppoſite to it from the back-part of the fibula, and then its tendon paſſing under the inner ancle, is inſerted into the under ſide of the laſt bone of the great toe. This extends the tarſus at a longer lever than it bends the toe.

Flexor pollicis pedis brevis.

Flexor pollicis pedis brevis is ſeemingly divided into two muſcles, by the tendon of the former paſſing over it, whence ſome authors name one part adductor pollicis, but they are both the ſame muſcle, and ariſe from the two leſſer oſſa cuneiformia and os cuboides and calcis. This muſcle is inſerted into the oſſa ſeſamoidea, which are tied by a ligament to the firſt bone of the great toe, reckoning only two bones to the great toe. Theſe muſcles bend the great toe.

Abductor pollicis pedis.

Abductor pollicis pedis ariſes from the os calcis and os naviculare, and paſſing by the os cuneiforme majus, and the external ſeſamoid bone of the great toe, it is inſerted into the firſt bone of the great toe. This muſcle is leſs an abductor than a flexor pollicis pedis; it alſo very much helps to conſtrict the foot lengthways.

Adductor pollicis pedis tranſverſalis.

Adductor pollicis pedis tranſverſalis ariſes from the lower end of the metatarſal bone of the toe next the leaſt, and is inſerted into the internal ſeſamoid bone. This truly is an adductor of the great toe, and helps to keep the conſtrictor of the bottom of the foot.

Extenſor digitorum pedis longus.

Extenſor digitorum pedis longus ariſes acute from the upper part of the tibia, and from the upper and middle part of the fibula and tranſverſe or interoſſeous ligament; then dividing into five tendons, four of them are inſerted into the ſecond bone of each leſſer toe, and the fifth into the beginning of the metatarſal bone of the leaſt toe, and ſometimes by a ſmall tendon alſo into the little toe. This laſt portion for the moſt part is ſeparate from its beginning, and may be accounted a diſtinct muſcle. The four firſt tendons only of this muſcle extend the toes, but the whole five bend the tarſus, and that with a longer lever than any of them bend a toe.

Extenſor digitorum pedis brevis

Extenſor digitorum pedis brevis ariſes, together with the extenſor pollicis brevis, from the os calcis, and dividing into three ſmall tendons, is inſerted into the ſecond joint of the three toes next the great one. The long extenſors of the toes ſerve not only to extend them, but alſo contribute to the bending of the ancle, which motions are uſually performed together in progreſſion; but the ſhort extenſors ariſing below the ancle, extend the toes only; and when the long extenſors are employed for that action only, the extenſors of the tarſus muſt act at the ſame time, to prevent the bending of the ancle. This is the reaſon why the toes have need, though their motions are leſs, of more extenſors than the fingers.

Flexor digitorum pedis brevis vel perforatus.

Flexor digitorum pedis brevis, vel perforatus pedis, is the flexor of the ſecond phalanx, and is the inmoſt of all the common muſcles of the toes. It ariſes from the under and back-part of the os calcis, thence paſſing toward the four leſſer toes, divides into four tendons which are inſerted into the beginning of the ſecond bone or phalanx of each of the leſſer toes. Theſe tendons are divided or perforated to let through the tendons of the following muſcles.

Flexor digitorum pedis longus vel perforans.

Flexor digitorum pedis longus, vel perforans, is the flexor of the third phalanx. It ariſes from the back part of the tibia, above the inſertion of the popliteus, and part of the fibula; thence deſcending under the os calcis to the bottom of the foot, it there becomes tendinous, often croſſes, and in moſt bodies communicates with the flexor longus pollicis pedis; then it divides into four tendons, which paſs through thoſe of the flexor brevis and are inſerted into the third bone of the four leſſer bones. This muſcle alſo extends the tarſus. The ſecond beginning of this muſcle ariſes from the os calcis, and joins the tendons where they divide. This portion only bends the toes; and ſeeing the flexor longus of the toes will, when it acts alone, extend the tarſus, as well as bend the toes, this portion, like the ſhort extenſors of the toes, ſeems purpoſely contrived to bend the toes alone.

Lumbricales pedis. Lumbricales pedis are the flexors of the firſt phalanx, and ariſe from the tendons of the perforans; they are inſerted into the firſt bone of each of the leſſer toes which they bend.

Abductor minimi digiti pedis. Abductor minimi digiti pedis ariſes by the perforatus from the os calcis, and being part of it inſerted into the metatarſal bone of the leaſt toe, it receives another beginning from the os cuboides, and is inſerted into the firſt bone of the leaſt toe, which it bends and pulls outward, and very much helps to conſtrict the bottom of the foot.

Abductor ſecundus minimi digiti pedis. Abductor ſecundus minimi digiti pedis, ariſes under the former muſcle from the metatarſal bone, and is inſerted into the little toe.

Interoſſei pedis. Interoſſei pedis are ſeven muſcles like thoſe of the hands, ariſing like them, from the metatarſal bones, and are inſerted into the laſt joints of the four leſſer toes; being in their progreſs attached to the tendons which extend the ſecond joints of the toes, they will extend both theſe joints. Theſe muſcles may be fitly divided into external and internal; the internal alſo bend the firſt joints, as do all the interoſſei in the hand, but here the outer ones extend the firſt joints; and if we conſider that the firſt of theſe muſcles is analogous to the abductor indicis of the hand, and that the abductor minimi is alike in both, we find that the muſcles to move the fingers and leſſer toes ſideways are alike in number, though this motion of the toes is in a manner loſt from the uſe of ſhoes. The muſcles that bend or extend the laſt joints of the toes will alſo move the ſecond and firſt, and thoſe that move the ſecond will alſo move the firſt, as they do in the fingers.

SECT. V.

Of the ARTERIES, VEINS, NERVES, and GLANDS of the LEG, &c.

Veſſels of the leg, &c. IN this ſection will be deſcribed all the blood-veſſels, nerves, and glands of the whole lower extremity, which includes the thigh, leg, and foot.

Arteria crurales. The iliac artery (Chap. v. Sect. 6.) goes out of the abdomen between the ligamentum Fallopii and tendon of the pſoas, at the union of the os ilium and os pubis, and there it takes the name of arteria cruralis. It ſends off firſt of all, three ſmall branches; one of which called pudica externa, goes over the crural vein to the ſkin and ligament of the penis and to the inguinal glands, communicating with the pudica interna. The ſecond branch goes to the muſculus pectineus; and the third to the upper part of the ſartorius. All theſe branches furniſh likewiſe the neighbouring anterior integuments. Afterwards the crural artery runs down on the head of the os femoris, and gets on the inſide of the crural vein about three fingers breadth from where it goes out of the abdomen. In this progreſs it is covered only by the ſkin and fat, and lies on the pectineus and triceps femoris. In changing its

Pudica externa.

its ſituation it ſends out the three following conſiderable branches. The external branch runs on the upper ſide of the thigh to the crureus, vaſtus externus, rectus tibiæ, faſcia lata, and glutæus medius; ſending up a branch to communicate with one from the pudica major, and ſciatica. The middle branch runs down on the inſide of the thigh between the heads of the triceps, to which muſcle it is diſtributed, and one of its ramifications perforates the triceps, and is diſtributed to the glutæus maximus, ſemitendinoſus, ſemimembranoſus, biceps, and to the neighbouring integuments. The internal branch runs backward on the quadrigemini, towards the great trochanter; and having ſent a branch into the joint of the os femoris, it then runs downward, and is ramified on all the muſcles that lie on the back-ſide of that bone, one of which enters the bone itſelf on one ſide of the linea aſpera.

The arteria cruralis having detached all theſe branches, runs down between the ſartorius, vaſtus internus, and triceps, giving branches to all the parts near it. It is covered by the ſartorius all the way to the lower part of the thigh, where it is inflected backward over the triceps a little above the internal condyle of the os femoris. Afterwards, continuing its courſe through the hollow of the ham, it is called arteria poplitea, being accompanied by the vein of the ſame name.

Poplitea. The arteria poplitea, while in the ham, is covered only by the integument, ſending off branches toward each ſide, which run up upon the condyles, and communicate with the lower ramifications of the cruralis. It ſends branches to the joint of the knee, one of which at leaſt paſſes between the crucial ligaments. As it runs down it ſends branches to the gaſtrocnemii and popliteus; and at the back-ſide of the head of the tibia ſends off a branch to each ſide. The internal branch ſurrounds the fore-part of the head of the tibia, paſſing between the bone and internal lateral ligament; and, beſides ſeveral other ramifications, ſendsup a ſmall branch which communicates with arteries round the condyles of the os femoris. The external branch runs over the head of the fibula, and between the head of the tibia and external lateral ligament of the knee, ſurrounding the articulation all the way to the ligament of the patella, and communicating with the ſame as the internal branch. Before the poplitea ends, it ſends a ſmall artery down on the back-ſide of the interoſſeous ligament, very near the tibia, into which it enters by a particular hole a little above the middle portion of the bone. As the poplitea ends, it divides into two principal branches, one of which runs between the heads of the tibia and fibula, paſſing from behind forwards on the interoſſeous ligament, where it takes the name of arteria tibialis anterior. The ſecond branch divides into two others, one internal and largeſt, called tibialis poſterior, the other, named arteria peronæa poſterior.

Tibialis anterior. The arteria tibialis anterior, having paſſed between the heads of the tibia and fibula, ſends ſmall branches upward and laterally. The ſuperior branches communicate with thoſe of the popliteus which lie round the articulation; and the lateral branches go to the neighbouring parts. Afterwards this tibial artery runs down on the fore-ſide of the interoſſeous ligament, toward the outſide of the tibia, between the muſculus tibialis anticus and extenſor pollicis. Having run laterally on the tibia for about two thirds of the length of that bone, it paſſes on the fore-ſide under the common annular ligament, and extenſor pollicis pedis to the articulation of the foot; giving off ſeveral branches both to the right and left hand, which communicate laterally with the tibialis poſterior and peronæa poſterior, ſo that theſe two bones are in a manner ſurrounded by arteries. At the joint of the foot it ſends out branches which run between the aſtragalus and os calcis, being diſtributed to the articulation and to the bones of the tarſus. The communications are here very numerous on all ſides. Having paſſed the fold of the foot it ſends off toward both ſides other branches, which communicate with the poſterior tibialis and peronæa; all theſe branches making a kind of circles round the tarſus. Afterwards the tibialis anterior advances on the convex ſide of the foot, as far as the interſtice between the firſt and ſecond metatarſal bones; between the heads of which, a large branch of it perforates the ſuperior interoſſeous muſcles, and joining the tibialis poſterior, forms an arch on the ſide of the foot. It likewiſe ſends two or three conſiderable branches over the other metatarſal bones, which go to the reſt of the interoſſeous muſcles, integuments, &c. and communicate with each other. Laſtly, this artery terminates by two principal branches, one of which goes to the thenar and inſide of the great toe; the other is ſpent upon the outſide of the great toe, and the inſide of the ſecond toe. Tibialis poſterior vel ſuralis. The tibialis poſterior, called likewiſe ſuralis, runs down between the ſolæi, tibialis poſticus, flexor digitorum communis, and flexor pollicis; giving branches to theſe muſcles, to the tibia, and to the marrow of that bone, through a particular canal in its poſterior and upper-part. Afterwards it runs behind the inner ancle, communicating with the tibialis anterior, and ſurrounded by the neighbouring veins; and paſſes to the ſole of the foot between the concave ſide of the os calcis and thenar muſcle, where it divides into two branches, one large or external, the other ſmall or internal.

Plantaris externa. The great branch, or arteria plantaris externa, paſſes on the concave ſide of the os calcis obliquely under the ſole of the foot, to the baſis of the fifth metatarſal bone, and from thence runs in a kind of arch toward the great toe, communicating there with the tibialis anterior, which perforates the interoſſeous muſcles in the manner already mentioned. The convex ſide of this arch ſupplies both ſides of the laſt three toes, and the outſide of the ſecond toe, forming ſmall communicating arches at the end, and ſometimes at the middle of each toe, as in the hand. The concave ſide of the arch furniſhes the neighbouring parts.

Plantaris interna. The ſmall branch, or arteria plantaris interna, having reached beyond the middle of the ſole of the foot, is divided into two; one of which goes to the great toe, communicating with the branch of the tibialis anterior; the other is diſtributed to the firſt phalanges of the other toes, communicating with the ramifications from the arch already mentioned.

Peronæa. The arteria peronæa runs down on the back-ſide of the fibula, between the ſolæus and flexor pollicis, to which, and to the neighbouring parts it gives branches in its paſſage. Having reached to the lower third part of the fibula, it ſends off a conſiderable branch, which runs in between the tibia and that bone, paſſing between their extremities from behind forward, below the interoſſeous ligament, and is diſtributed to the integuments of the tarſus. Laſtly, the peronæa continuing its courſe downward, on the back-ſide of the fibula, as far as the os calcis, forms an arch with the tibialis poſterior, between the aſtragalus and the tendo Achillis; from thence it runs outward, and a little above the outer ancle communicates with the tibialis anterior by an arch, which ſends ſeveral ſmall ramifications to the neighbouring parts.

In the particular deſcription of the arteries throughout this work, I have ſaid nothing of the cutaneous anaſtomoſes, which are exceedingly beautiful in the fœtus; nor of the frequent and conſiderable communications of ſmall arteries upon the perioſtæum, which form a delicate kind of net-work, or rete mirabile.

Vena cruralis. The crural vein goes out under the ligamentum Fallopii, on the inſide of the crural artery, and immediately gives ſmall branches to the inguinal glands, the muſculus pectineus, and parts of generation. Theſe laſt are termed pudicæ externæ, and evidently communicate with the internal veins of the ſame name. About an inch below where it leaves the abdomen, it produces a large

branch,

branch, which runs down anteriorly between the integuments and the ſartorius, following the direction of that muſcle almoſt all the way to the inſide of the thigh. This branch having afterwards got beyond the condyles of the os femoris, runs down between the integuments and inner angle of the tibia, to the fore-part of the inner ancle, and is diſtributed to the foot. All this large branch is named vena ſaphena or ſaphena major. After the origin of the ſaphena, as the trunk of the crural vein runs down, it ſinks in between the muſcles, and is diſtributed to all the inner or deep parts of the lower extremity, accompanying the crural artery to the very extremity of the foot, being all along more conſiderable than the artery, both for capacity and ramifications, a thing very common in the veins. As the ſaphena is a vein of very large extent, I ſhall here deſcribe it altogether, and afterwards return to the vena cruralis.

Vena ſaphena. The vena ſaphena, in its paſſage from the inguen to the foot, is covered only by the ſkin and fat. Immediately after its riſe it gives ſmall veins to the inferior inguinal glands; and then others more anteriorly, which running under the integuments, communicate with each other by numerous areolæ, or meſhes. The ſaphena having run down on the thigh, as low as the middle of the ſartorius, ſends off to the ſame ſide ſeveral branches, which communicate with each other, and with the ſuperior branches already mentioned; and as they run down, they communicate again with the trunk of the ſaphena. Between theſe upper and lower branches, the ſaphena ſends backward a particular branch; which, after being diſtributed to the integuments which cover the gracilis and triceps, turns backward; and a little below the ham, runs in among the muſcles ſituated there, and communicates with another branch, which may be termed ſaphena minor. Afterwards the trunk of the great ſaphena runs down on the inſide of the tibia, lying always near the ſkin; and at the upper part of that bone, it ſends branches forward, outward, and backward.

The anterior branches go to the integuments on the upper part of the leg; the poſterior, to thoſe which cover the gaſtrocnemii, and communicate with the little ſaphena; and the external branches are likewiſe diſtributed to the fat and integuments, and having reached as low as the middle of the tibia, it ſends a communicating branch to the trunk of the great ſaphena, and from this goes out a branch anteriorly, which runs along the integuments of the tibia all the way to the outer ancle, having in its paſſage communicated again with the great ſaphena. As the ſaphena runs down on the inſide of the tibia, it ſends out a branch near the middle of that bone, which runs up behind the tendons of the ſartorius, gracilis, and ſemitendinoſus, then between the tibia and upper end of the ſolæus, and is joined by an anaſtomoſis with the crural vein. It likewiſe ſends branches to the fore-part of the tibia which are diſtributed to the perioſteum and bone, communicating with the other branches already mentioned. At the lower part of the tibia, the ſaphena produces a conſiderable branch, which runs obliquely forward over the joint of the tarſus toward the outer ancle, ſending off ſeveral branches which communicate with each other, and with the trunk of the ſaphena. Laſtly, the extremity of this trunk paſſes on the foreſide of the inner ancle, and runs under the ſkin along the interſtice between the firſt two metatarſal bones toward the great toe, where this vein terminates. Having got below the inner ancle, it ſends a branch outward and forward, which runs under, and partly accompanies the anterior tibial artery. Interiorly it ſends another branch almoſt from the ſame place, which paſſes under the foot, communicating with the external tibial vein by irregular arches, from which veins are ſent to the toes. Laſtly, before the ſaphena terminates at the great toe, it forms a kind of arch over the metatarſus, which communicates by ſeveral branches with that arch on the joint of the tarſus, and ſends others to the toes. This arch gives off likewiſe another branch which runs up behind the outer ancle, and communicates with the vena tibialis externa.

Continuation of the vena cruralis. The crural vein having ſent off the ſaphena, and the ſmall branches for the pectineus, &c as has been ſaid, runs down on the thigh behind the crural artery. Oppoſite to the little trochanter, it produces two large ſhort branches, or one which afterwards divides into two. The anterior branch runs tranſverſely forward, to be diſtributed to the vaſtus internus, and the lower part of the pectineus and triceps, running in between them as it goes from one to the other. The poſterior branch runs tranſverſely backward, and furniſhes the glutæi, vaſtus externus, and beginning of the biceps tibiæ.

A little below theſe two branches, about the upper extremity of the vaſtus internus, the crural vein produces a branch which runs down on the ſide of the trunk, covering the crural artery, almoſt as low as the ham, where it is again united to the trunk by an anaſtomoſis. It has the name of vena ſciatica from the ſciatic nerve which it accompanies. **Sciatica.**

On the outſide of this anaſtomoſis, the crural vein gives off a branch which runs backward between the biceps and neighbouring muſcles, and ſo down the back-ſide of the leg very near the ſkin, all the way to the outer ancle. This vein is termed ſaphena minor, or externa; in its courſe downward, it gives out a branch which runs backward and communicates with the great ſaphena about the middle of the back-ſide of the thigh. Immediately above and below the ham, this vein ſends out other branches, which likewiſe communicate with the ſaphena major, and having run down about one third part of the back-ſide of the tibia, it ſends off another branch, which is afterwards re-united to the trunk. About the beginning of the tendo Achillis, the little ſaphena runs outward in the integuments, toward the outer ancles, where it terminates in cutaneous ramifications ſent to every ſide. **Saphena minor.**

The crural vein having ſent off the little ſaphena, runs down between the biceps and other flexor muſcles of the leg, cloſely accompanied by the crural artery, between which and the inner condyle of the os femoris, it is ſituated. A little above the ham it takes the name of vena poplitea, and as it runs **Vena poplitea.**

runs down betwixt the two condyles, it gives branches to the flexor muſcles abovementioned, to the lower and poſterior parts of both vaſti, and to the fat which lies above the interſtices of the two condyles. Another branch runs up laterally, between the outer condyle and the biceps, and then turning forward is ramified like the artery; another branch goes backward down to the tendo Achillis, being ramified as it paſſes on the gaſterocnemii. Near the condyles, it ſends lateral branches to the extremities of the neighbouring muſcles, eſpecially thoſe of the ſemitendinoſus, ſemimembranoſus, peronæus longus, &c. The vena poplitea runs down behind the muſculus popliteus, and at its lower part is ramified on each ſide, which branches communicate with one another. Afterwards, it loſes its name, being divided into three conſiderable branches, called tibialis anterior, tibialis poſterior, and peronæa; of which the tibialis poſterior is moſt frequently a continuation of the trunk, and the other two like branches.

Vena tibialis anterior. The anterior tibial vein, having ſent ſome ſmall branches to the muſcles behind the heads of the two bones of the leg, perforates the interoſſeous ligament from behind forward, and runs between the ſuperior portions of the muſculus tibialis anticus, and extenſor digitorum pedis. As ſoon as it pierces the interoſſeous ligament, it ſends ſmall ſuperficial branches to the head of the tibia and fibula, and to the joint of the knee, which communicate with the lateral branches of the poplitea. Afterwards, it divides into two or three branches, which run down together on the fore-ſide of the interoſſeous ligament with the anterior tibial artery, ſurrounding it by ſmall communicating circles. Theſe branches having reached the lower extremity of the leg, unite in one, which afterwards divides into ſeveral, the ramifications of which are diſtributed to the foot. A particular branch goes out from the re-united portion, which at the lower part of the leg, perforates the interoſſeous ligament from before backward, and communicates with the vena tibialis poſterior.

Vena tibialis poſterior.

The poſterior tibial vein ſends off a branch from its origin toward the inſide, which is diſtributed to the gaſterocnemii and ſolæus. This vein is named ſuralis. Afterward the poſterior tibialis runs down between the ſolæus and tibialis poſticus, giving branches to each of them. It is divided in the ſame manner as the tibialis anterior, into two or three branches, which alſo ſurround the correſponding artery by ſmall communicating circles. It accompanies the artery as low as the outer ancle, furniſhing the muſculus tibialis poſticus, and the long flexors of the toes. At the lower part of the leg, it communicates with a tranſverſe branch of the ſaphena, and with the anterior tibial vein, as before obſerved. Laſtly, it paſſes on the inſide of the os calcis, under the ſole of the foot, where it forms the venæ plantares, by dividing into ſeveral tranſverſe arches, which communicate with each other, and with the ſaphena; ſending ramifications to the toes, nearly in the ſame manner as the arteriæ plantares.

Suralis.

Plantares.

Vena peronæa.

The vena peronæa is likewiſe double, and ſometimes triple. It runs down on the inſide of the fibula in the ſame manner as the ar-

arteria peronæa, which it likewiſe ſurrounds by communicating branches, after the manner of the tibialis poſterior. It runs down as low as the outer ancle, communicating ſeveral times with the tibialis poſterior, ſending ramifications to the muſculi peronæi, and long flexors of the toes. The laſt of theſe communications makes the venæ plantares in ſome ſubjects appear as if they come from this vein.

Nerves of the leg, &c.

By the union of branches from the firſt, ſecond, third, and fourth lumbar nerves, the anterior crural nerve is formed, which running along the muſculus pſoas, eſcapes with the large blood-veſſels out of the abdomen below the tendinous arcade of its muſcles, and is diſtributed to the muſcles and teguments on the fore-part of the thigh: one branch of this crural nerve accompanies the vena ſaphena as far as the ancle. Now let us imagine the ſituation of the kidney upon, and the courſe of the ureter over theſe nerves, and we ſhall not be ſurpriſed, that in a nephritis the trunk of the body cannot be raiſed erect without great pain; that the thigh loſes of its ſenſibility, and that it is drawn forwards. The remainder of the fourth and the fifth lumbar nerves, join with the firſt, ſecond, and third, that proceed from the os ſacrum: theſe five, when united, conſtitute the largeſt nerve of the body, ſo well known by the name of the ſciatic, or iſchiatic nerve, which ſeems to be bigger in proportion than the nerves of any other part; the deſign of which, may be to afford ſufficient ſtrength to the muſcles of the lower extremity, for exerting a force ſuperior to what is required in any other part of the body. When this nerve is any way obſtructed, we ſee how unable we are to ſupport ourſelves, or to walk.

The ſciatic nerve then goes out at the large hollow, behind the great tubercle of the os iſchium, and paſſing over the quadrigemini muſcles, runs down the poſterior part of the thigh, giving off, every where as it goes, nerves to the teguments and muſcles of the thigh and leg. At the ham it ſplits into two; the ſmaller mounts over the fibula, and ſerving the muſcular peronæi, flexores pedis, and extenſores digitorum, is continued to the toes along the broad of the foot, while the larger trunk ſinks under the muſculi gaſterocnemii and then divides; one is ſpent on the muſcles of the back of the leg and teguments, while the other is continued by the inner ancle to the foot, and then ſubdivides; one branch is diſtributed after the ſame manner as the ulnaris, and the other as the radialis in the hand.

Glands of the leg, &c.

The inguinal glands are ſituated on each ſide in the groin near the crural veſſels, and are in various diſeaſes apt to grow tumid, and inflamed. Abſceſſes are often formed in them; but their uſe in the body is not eaſily underſtood.

About the flexure of the knee and foot there are alſo found here and there ſome ſmall glands; as alſo in ſome places between and among the muſcles: but theſe are here omitted for the reaſon formerly mentioned.

CHAP.

CHAP. VIII.

SECT. I.

Of various Subjects.

Of various ſubjects.

IN this chapter, I ſhall deſcribe the parts of generation of both ſexes, which did not come properly under the foregoing heads, and were therefore purpoſely omitted in the preceding chapters; alſo, the parts of the eye and ear not yet mentioned, together with the five ſenſes, viz. ſeeing, hearing, ſmelling, taſting, and feeling. There will be alſo given for the young anatomiſt's better information, ſome account of the embryo, and fœtus in utero; muſcular motion, reſpiration, perſpiration. and ſecretion: likewiſe, an account of the ſucceſſive different changes the aliments undergo from the mouth to their being mixed with, and converted into blood; the nature and properties of the blood, the manner of its circulation, and the motion of the pulſe.

SECT. II.

Of the PARTS of GENERATION in both Sexes.

Parts of generation proper to men.

THE parts of generation proper to men may be fitly divided into thoſe which prepare and ſeparate the ſeed from the blood, and thoſe which convey it into the womb. The firſt is done by three ſorts of glands, which are the teſtes, veſiculæ ſeminales, and the proſtatæ; the ſecond is the office of the penis.

Teſtes. The teſtes, or teſticles, ſeparate the ſeed from the blood, and are two oval bodies ſeated in the ſcrotum; they are defended from cold and other injuries, by ſeveral membranes, or coats. The moſt external is called the ſcrotum; which is made up of the epidermis, cutis, and immediately under the latter a thick cellular texture, cloſely adhering to it; but without muſcular fibres, which many anatomiſts have aſſigned it. This covering is common to both teſtes.

Dartos. The looſe membrane immediately underneath is called dartos, which invelopes each teſticle ſingly, and by the junction of both together, where their ſides are contiguous, make a ſeptum, or partition betwixt the two teſtes. It is likewiſe wholly cellular, without muſcular fibres, and without fat. Under the dartos is the cremaſter muſcle, one to each teſticle. It is probably owing to the action of this muſcle, that the ſcrotum is gathered up into rugæ by cold; as neither it nor the dartos are furniſhed with muſcular fibres, as before obſerved.

Tunica vel proceſſus vaginalis. Under this muſcle, is the firſt of the proper integuments, or coats, called proceſſus vaginalis, tunica vaginalis, and elythroides; which is formed by the dilatation of the productions of the external membranes of the peritonæum through the abdominal rings. This coat is continued from the peritonæum to the teſticle, which it embraces looſely, the whole body of the teſticle adhering to one end of the epididymis mentioned below; it encloſes the ſpermatic veins and arteries termed vaſa preparantia; and likewiſe thoſe veſſels which convey the ſemen from the teſticles to the veſiculæ ſeminales, called vaſa deferentia; but it is divided by a ſeptum, or an adheſion immediately above the teſticle, ſo that no liquor can paſs out of that part of this membrane which encloſes the ſpermatic veſſels into that which encloſes the teſticle. Large quantities of water (which is termed the hydrops teſtis) are ſometimes found in either or both of theſe cavities, which diſeaſe is eaſily remedied by a puncture with a lancet, but rarely cured without opening the cavity where the water is contained, as in ſinuous ulcers. The true hernia aquoſa is from the abdomen, which either extends the peritonæum into the ſcrotum, or breaks it, and then forms a new membrane which thickens as it extends, as in the aneuriſms and atheromatous tumors. The dropſy in this cyſt, for ſuch it properly is, rarely admits of more than a palliative cure by puncture or tapping, like the dropſy of the abdomen, and this with ſome difficulty, becauſe the omentum uſually, and ſometimes the gut, deſcends with it.

Tunica albuginea.

The other proper and laſt coat, which covers and immediately incloſes the teſticles, is called albuginea from its white colour; it is ſtrong and thick, very ſmooth and equal: the branches of the vaſa preparantia are finely weaved upon it.

Subſtance of the teſticles.

The ſubſtance, or kernelly part, of the teſticles, is of a white colour, and of a pretty firm texture, univerſally allowed to be a continuation of the evaneſcent branches of the ſpermatic artery, rolled up together. It is divided into more than twenty portions or cluſters, ſeparated from one another by as many partitions, which are productions of the albuginea. Haller, by his experiments, finds that each cluſter contained between two partitions, terminates in one duct; which ducts, above twenty in number, meeting together, form a kind of net-work adhering to the albuginea; every duct anaſtomiſing with theſe contiguous to it. From this net-work ariſe ten or twelve other diſtinct ducts, which being ſeparately bent and folded in a wonderful manner, make as many vaſcular cones, and by their uniting conſtitute the head or beginning of the epididymis; and quickly by their conflux form one larger duct.

Epididymis This ſingle duct, variouſly bent and folded into ſerpentine windings faſtened together by cellular texture, makes a roundiſh hard body on the upper and poſterior part of the teſticle, called epididymis, as it were an additional teſticle; and at length terminates in the vas deferens, from whence, it is evident, the epididymi are the beginning of the vaſa deferentia, which are excretory ducts to carry the elaborated ſeed into the veſiculæ ſeminales. Vaſa deferentia. They paſs from the epididymi of the teſticles, together with the blood veſſels, through the abdominal rings, all enveloped in one common ſheath (the tunica vaginalis) called the ſpermatic cord or rope. When they have entered the abdomen, they ſeparate from the ſpermatic veſſels, and paſs directly through the pelvis cloſe to the bladder to the veſiculæ ſeminales.

Vaſa preparantia. The ſpermatic veins and arteries are termed vaſa preparantia as before obſerved. The ſpermatic artery (one on each ſide) ariſes from the aorta deſcendens inferior, and is diſtributed as formerly mentioned. It is the ſmalleſt artery in the whole body for the length it runs: the ſpermatic veins accompany the arteries through the abdominal rings to the teſtis; where the arteries giving off twigs to the coats of the teſtis, and to the cremaſter muſcle, their principal branches penetrate through the albuginea by two plexuſes; one at the upper end, the other at the lower end of the teſtis, into the ſecretory ſtructure. And as there is no red blood found in the ſubſtance of the teſtis within the albuginea, moſt certainly ſecretion begins immediately upon the entry of the arterial twigs into that ſubſtance. Theſe arteries, unlike all others, ariſe ſmall, and dilate in their progreſs, that the velocity of the blood may be ſufficiently abated for the ſecretion of ſo viſcid a fluid as the ſeed. The right teſticle returns its vein into the cava, and the left into the emulgent vein on the ſame ſide as before mentioned; both becauſe it is the readieſt courſe, and becauſe, as authors ſay, this ſpermatic vein may not be obliged to croſs the aorta, whoſe pulſe would be ſubject to ſtop the blood which returns from the teſticles very ſlowly, by reaſon of the narrow orifices of the ſpermatic arteries, and the largeneſs of the veins. The teſticles have many lymphæducts, which diſcharge themſelves into the inguinal glands. Their nerves come from the intercoſtal and twenty-firſt of the ſpine. The ſpermatic arteries carry the blood from the aorta to the teſticles, which ſeparate that part of it which is fit for ſeed. The veins carry back to the cava what blood remains after the ſecretion of the ſeed. The ſeed is farther purified in the epididymes, and in coition is carried by the vaſa deferentia into the urethra.

Veſiculæ ſeminales.

Veſiculæ ſeminales are two membranous bags or receptacles, one on each ſide, ſituated at the lower and poſterior part of the neck of the bladder, into which the ſemen is received from the vas deferens, and there depoſited and accumulated, till it is thrown out by the urethra in the venereal act. They are each of them one uninterrupted cavity, ſhut at one end, and ſending out a duct at the other, into which duct the vas deferens opens. The external membrane is made up of muſcular fibres which in time of coition contract and preſs the veſiculæ, ejecting the ſeed through the proſtate glands into the urethra.

The ſeed paſſes in time of coition from the vaſa deferentia as well as from theſe receptacles; for when the ducts into the urethra are diſtended, that is the direct courſe from the vaſa deferentia as well as from the veſiculæ ſeminales.

Proſtatæ.

Proſtatæ are two glands, or rather one, about the ſize of a walnut. Theſe glands lie between the veſiculæ ſeminales and penis, under the oſſa pubis, almoſt within the pelvis, ſurrounding, and cloſely embracing the beginning of the urethra. They ſeparate a limpid glutinous humor, which is carried into the urethra by ſeveral ducts, which enter near thoſe of the proſtatæ. This liquor is thrown into the urethra in the act of generation, along with the ſemen, and is mixed with it, to make it flow more eaſily. If the venereal infection reaches the proſtrate glands, it will ſometimes make large abſceſſes, which are apt to form ſinuſes, and even make a paſſage into the bladder. It is often cured by opening the ſinuſes and conſuming the diſeaſed parts by eſcharotics; but a much better and eaſier way is to cut out all the fiſtulous and diſeaſed parts at once. Having treated of the parts which prepare and retain the ſemen, I proceed to conſider the remaining organs concerned in generation, or thoſe which tranſmit it to the uterus muliebris, viz. the penis, and urethra.

Penis. The ſhape, ſituation, and uſe of the penis are ſo well known, as to need no deſcription. The ſubſtance of the penis is compoſed of two ſpongious bodies, called corpora cavernoſa, part of the urethra, the glands, or nut at its extremity, and its integuments. The two corpora cavernoſa vel ſpongioſa, which during erection makes the chief bulk of the penis, ariſe from the os pubis on each ſide, and are continued to the root of the glans. They ariſe diſtinct, but are ſoon after united divided only by a ſeptum its whole length; it is ſtrongly connected to the os pubis by a ſmall ligament, which ariſes from its back. They take their name from being porous like ſponge, and capable of being enlarged by the blood penetrating their ſubſtance, which forms a ſort of looſe net-work internally, upon which the branches of the blood veſſels are curiouſly ſpread. When the blood is ſtopped in the great veins of the penis, that which comes by the arteries runs through ſeveral ſmall holes in the ſide of their capillary branches into the cavities of the net-work, by which means the corpora cavernoſa become diſtended, and the penis erected.

Urethra. Along the under-ſide of the corpora cavernoſa, there runs a canal called the urethra, through which, both the urine and ſeed paſs; it begins at the neck of the bladder, and runs in a furrow between the two corpora ſpongioſa penis to the extremity of the glans. Its whole length, without the erection of the penis, is about twelve or thirteen inches: its thickneſs about that of a gooſe quill. It conſiſts of two thick ſtrong membranes, with a ſpongy texture between them: its begining at the neck of the bladder, is ſurrounded and covered by the proſtatæ, as hath been ſaid; at its emerſion from which gland it becomes thicker and wider for the length of an inch, which thick part is called its bulb, from the reſemblance it bears to a bulbous root. Its inner membrane is pierced with many holes here and there, through which, from a glandular apparatus in the ſpongy ſubſtance of the urethra, a mucilaginous liquor is furniſhed; ſerving to defend it againſt the acrimony of the urine. Beſides theſe orifices, which ſome authors call lacunæ, Cowper, in a particular treatiſe, hath deſcribed and beautifully delineated three glands, two near the bulb of the urethra, one on each ſide, about the bigneſs of a pea, and a third, leſs than the other two, at the bending of the urethra under the os pubis. The firſt two are often found; but ſometimes wanting or very ſmall: the third is but ſeldom met with by the beſt anatomiſts. Where they exiſt, they probably ſerve for the ſame uſe as the other lacunæ. Women, though their urethra is ſhorter and wider, are not without the ſame kind of lacunæ, ſerving for the ſame uſe, and liable to the ſame infection mentioned below. All theſe glands have excretory ducts into the urethra, and from them are ſecreted all the matter which flows from the urethra in a gonorrhœa, whether venereal or not. In the venereal infection, the urethra and the glands are firſt inflamed by the contagious matter that cauſes a heat of urine, which abates as ſoon as the glands begin to diſcharge freely, but if by chance this diſeaſe continues till any part of the urethra is ulcerated, the ulcer never heals without a cicatrix, which conſtricts the urethra, and occaſions what is vulgarly called a caruncle.

Glans penis. The glans of the penis, though, in appearance, a part of its body, is in reality a continuation of the ſpongy ſubſtance of the urethra, reflected over its extremity, and expanded in the form we ſee. It is covered over with a thin epidermis, under which there are numerous nervous papillæ, which render it extremely ſenſible.

Præputium. The integuments of the penis are firſt the cuticula and cutis, which being folded back, and adhering round the root of the glans, form the præputium or fore ſkin; the ſmall ligament, by which the præputium is tied to the other ſide of the glans, is called frænum. The uſe of the præputium is to keep the glans ſoft and moiſt that it may have the more exquiſite ſenſe.

Under the common integument above mentioned, the penis hath a proper coat covering all its body, from the glands excluſive backwards: it is of a tough tendinous texture.

Veſſels of the penis. On the upper ſide of the penis are two arteries, and one vein called vena ipſius penis. The arteries are derived from the hypogaſtrics, and the vein runs alſo back to the iliac veins. It has two nerves from the os ſa-

ſacrum, and ſeveral lymphatics, which empty themſelves into the inguinal glands.

Parts of generation proper to women.

The external parts of generation in women are the mons veneris, which is that riſing of fat covered with hair above the vulva or rima magna, upon the os pubis; the great doubling of the ſkin on each ſide the rima is called labia, which is only the ſkin ſwelled by the fat underneath. Theſe lips being a little ſeparated, there appear the nymphæ, one on each ſide the rima. In the angle which the nymphæ form in the great chink next the os pubis, is the extremity of the clitoris, ſtrait under which appears the meatus urinarius or orifice of the urethra. On the oppoſite ſide next the anus are the glandulæ myrtiformes, ſituated in the foſſa magna or interior cavity of the pudendum muliebre; and in this angle of the chink, there is a ligament called the fork, which is torn in the firſt birth.

Nymphæ.

Nymphæ are two membranous parts, ſituated interiorly on each ſide the rima; theſe two ſmall bodies are red, and ſomewhat reſemble the membranes, or wattles, under a cock's throat. They are ſometimes ſmaller, ſometimes larger, and are continuous to the præputium of the clitoris, and joined to the interior ſide of the labia as before obſerved. The nymphæ are ſpongious in their internal ſubſtance, and full of blood-veſſels, and therefore they ſwell in coition; they receive veſſels and nerves as the clitoris. The nymphæ are full of nervous papillæ, whence their quick ſenſe: they have alſo ſmall glands, that ſecrete a fatty matter. Their uſe ſeems to be to increaſe the pleaſure in coition; to direct the courſe of the urine; and to defend the internal parts from external injuries: they are bigger in married women than in maids. The nymphæ are ſometimes ſo large, as not only to hang without the labia pudendi, but alſo to prove very troubleſome to the woman in walking, ſitting, and in conjugal embraces, ſo as to require the ſurgeon's aſſiſtance to extirpate as much as is neceſſary. This operation is rarely found neceſſary in our parts of the world, but is frequently practiſed in the Eaſt; being properly the circumciſion of women.

Clitoris. The clitoris (which ſome call mentula muliebris) is ſituated in the fore part of the vulva, at the angle which the nymphæ form with each other. It is generally about the bigneſs of the uvula, and its ſhape much reſembles the ſhape of that part, yet it is ſometimes found as large as the penis: but even in this caſe it has no urethra. for though it has a glans like the penis, it is not perforated. The prepuce covering the glans of the clitoris, is formed of the cutis of the pudendum, and furniſhed with nervous papillæ: hence it is of exquiſite ſenſibility to the touch. The clitoris, in its common natural ſtate, lies entirely buried under the ſkin or prepuce; no part of it appearing but its extremity covered with the præputium. The ſubſtance of the clitoris is compoſed of two ſpongious bodies, ſuch as thoſe of the penis; they ariſe diſtinctly from the lower part of the os pubis, and ſoon after unite and form the body of the clitoris and its glans, which is of exquiſite ſenſe as above mentioned. Before theſe ſponginous bodies unite, they are called crura, as thoſe of the penis; the two muſcles which are ſaid to erect the clitoris in coition, in the ſame manner as the muſcles of the penis erect that part, are already ſpoken of. The glans of the clitoris is uſually covered with a fœtid matter, like that of the glans of the penis. It is alſo connected to the os pubis, by a ligament, in the ſame manner as the penis is in men. The clitoris receives veins and arteries from the hæmorrhoidal veſſels and the pudenda; and nerves from the intercoſtals, which are likewiſe diſtributed through all the parts of the vulva. The uſe of the clitoris is to produce a titillation in coition, and it is ſaid to be the chief ſeat of pleaſure in that act, as the glans is in men.

Internal parts.

The internal parts of generation proper to women, are the vagina, uterus or womb, ovaries and Fallopian tubes; of which in their order. A little lower than the clitoris, between it and the vagina, or rather juſt within the vagina, is the orifice of the urethra termed meatus urinarius. The urethra in women is the ſame as in men, only ſhorter, wider, and more ſtrait; it is naturally as big as a gooſe quill.

Meatus urinarius.

Vagina.

Vagina or the neck of the womb is a large canal which reaches from the external orifice or os pudendi, to the internal mouth of the uterus. It is uſually about five or ſix fingers breadth long in maids, and one and a half broad; but it varies in different ſubjects, and in married women who have born children, its length and bigneſs cannot be determined, becauſe it lengthens in the time a woman is with child, and it dilates in the time of birth, being very diſtenſible, and capable of great dilatation. The texture of the vagina is membranous, being compoſed of two membranes, of which the inner, which lines its cavity, is nervous, and full of wrinkles and ſulci, eſpecially in its fore-part. It has three or four ſmall glands on that ſide next the rectum, which pour into it a viſcous humour in time of copulation. The rugæ or wrinkles of this membrane are for the friction of the balanus or glans penis, to increaſe the pleaſure in coition both to the man and woman; and to render the part capable of the neceſſary dilatation in parturition. Theſe rugæ are largeſt in maids; in married women they are much fainter, and ſeem as if worn down; and in women who have born children, they are almoſt entirely obliterated. The external membrane of the vagina is made of muſcular fibres, which, as occaſion requires, dilate and contract, become long or ſhort, for adjuſting its cavity to the length and bigneſs of the penis.

The lower part, or orifice of the vagina, is contracted with a ſphincter, that it may graſp the penis cloſely; (See Muſcul. Sphincter Vaginæ.) and to the abundance of nervous papillæ in the inner membrane, is owing its quick ſenſation. The oſcular orifices of the excretory ducts of the glands, ſituated under the rugæ of the vagina before mentioned, are called lacunæ: theſe glands are the ſeat of a gonorrhœa in this ſex, as the glands in the urethra are in the male. The vagina receives veins and arteries from the hypogaſtric and hæmorrhoidal veſſels. Thoſe from the hypogaſtric are diſperſed in its upper part; and thoſe from the hæmorrhoidal into its lower; theſe veſſels communicate with one another. It has nerves from the os ſacrum. The uſe of the vagina is not only to receive the penis in coition as has been ſaid, but alſo to emit from the womb the menſtrual diſcharges, the fœtus, the ſecundines, and lochia.

Hymen. Near the beginning of the vagina, immediately behind the orifice of the meatus urinarius, is ſituated a valve called Hymen, (from the God of Marriage, in the Heathen Mythology) which commonly paſſes among us for a teſt of virginity; but the moſt curious anatomiſts are greatly divided, not only about the figure, ſubſtance, place, and perforations of this membrane, but even about its exiſtence; ſome poſitively affirming, and others as flatly denying it; however, as I am inclined to the former opinion, ſhall give the moſt rational account of it that I have met with in Mr. Cheſelden's own words.

"The Hymen is a valve conſtantly found in the vagina of children, which, looking towards the orifice of the vagina, cloſes it; but as children grow up, and the ſphincter vaginæ grows ſtrong enough to contract and cloſe the orifice of the vagina, this valve becoming uſeleſs, ceaſes to encreaſe, and is there known by the name of glandulæ or carunculæ myrtiformes."

Carunculæ myrtiformes. There have been a few inſtances in which the edges of this growing together, it continued unperforate, until it has been neceſſary to make an inciſion to let out the menſes.

Uterus. Uterus, the womb, is ſeated at the end of the vagina, and lies alſo between the bladder and rectum. The os pubis is a fence to it before, the os ſacrum behind, and the ilium on each ſide, theſe forming as it were a baſon for it, termed the pelvis; but, becauſe it muſt ſwell whilſt women are with child, there is a greater ſpace between theſe bones than in men; and for this reaſon it is, that women are bigger in the haunches than men. The figure of the uterus is like a pear, from its internal orifice to its bottom; in women not with child, the length of the uterus is about three inches; its breadth in the upper part two, and in the lower part one inch; its thickneſs is about an inch and an half. In maids, indeed, the uterus is much ſmaller than this (the cavity being about the ſize of a ſmall almond:) but in women with child it is larger, according to the time of geſtation. It preſſes the bowels, and reaches to the navel towards the time of delivery; whilſt at other times, it does not riſe above the os ſacrum. The upper and broader part of the uterus is called the fundus; and the lower part, into which the vagina opens is termed the cervix: its orifice into the vagina is called os uteri, and by ſome os tincæ, from the reſemblance it bears to a tench's mouth; it may be alſo compared to the mouth of a young puppy dog, and the glans penis. This internal mouth of the womb is very ſmall in virgins, but in women who have had children, or who are with child, it is larger; and in the laſt it is always cloſed up with a glutinous humour. In the time of delivery, it in a wonderful manner expands itſelf, ſo as to give paſſage to the child. The ſubſtance of the womb is vaſcular, being compoſed of a various plexus of fleſhy fibres, with a great number of veſſels between; in women not with child it is compact and firm; in thoſe with child it is ſpongy and ſinuous, and is capable of wonderful dilatation,

tion, without any diminution of its thickneſs. Its bottom or fundus grows thick as it dilates, ſo that in the laſt months of geſtation, it is leaſt an inch thick, where the placenta adheres, becauſe its roots run into the ſubſtance of the womb. The uterus is covered externally with a membrane from the peritonæum, and internally, its cavity is lined with a porous and nervous membrane; but in women with child this inner membrane almoſt entirely diſappears. The blood-veſſels of the uterus are tortuous, and make a vaſt number of anaſtomoſes with one another: they open by a number of little mouths into the uterus and vagina, and are the ſources of the menſtrual diſcharge.

Veſſels, &c. of the uterus.

The arteries and veins of the uterus are branches of the hypogaſtric and ſpermatic veſſels, whoſe large ramifications inoſculate with each other, as alſo, the branches on one ſide of the womb with thoſe of the other. The veins are greatly larger than the arteries, eſpecially in women with child.

Menſes, &c.

About the age of puberty, when the blood which uſed to be ſpent in the increaſe of the body, being accumulated, diſtends the veſſels, it breaks forth once a month at thoſe of the uterus; becauſe of all the veins of the body, which ſtand perpendicular to the horizon, theſe only are without valves. This evacuation is called menſtrua, menſes, and catamenia; and vulgarly flowers, courſes, &c.

The nerves of the womb come from the intercoſtals, and from thoſe which come from the os ſacrum. There are alſo ſeveral lymphatics upon its outſide, which unite by little and little into greater branches, and diſcharge themſelves into the reſervatory of the chyle. The uterus is tied by two round ligaments; and by what is called the ligamenta lata, being like two broad ligaments, though it is only a production or continuation of the peritonæum, from the ſides of the womb; the ovaria are faſtened to one of the ligamenta lata, and the tubæ Fallopianæ run along the other; theſe productions, or continuation of the peritonæum, are commonly compared to the wings of a bat, and are therefore called veſpertilionis alæ. Ligamenta rotunda. The two round ligaments, or ligamenta rotunda, which ariſe from the ſides of the uterus, and paſs through the oblique and tranſverſe muſcles of the abdomen to the groin, in the ſame manner as the ſeminal veſſels do in men. This way the gut paſſes in a hernia inteſtinalis in women. (See Muſcles of the Abdomen). Theſe ligaments are partly continued, or joined to the muſculus faſcia lata, on the upper part of the inſide of the thigh; and from thence comes the pain that women big with child, feel in this place. The ſubſtance of theſe ligaments is hard, but covered with a great number of blood-veſſels; they are pretty big at the bottom of the womb, but they grow ſmaller and flatter, as they approach the os pubis.

Ovaria. Ovaria, termed by the ancients teſtes muliebres, are two bodies of a depreſſed oval figure, ſituated one on each ſide the fundus uteri; they are commonly about half the ſize of men's teſticles, but differ according to the age and temperament of the ſubject. They are white, ſmooth, and largeſt in perſons in the vigour of their age, and in women who are amorous; in ſuch ſubjects they are found of two drachms weight, and furniſhed with a number of prominent veſicles. In old people, they ſcarce weigh half a drachm, and are dry, corrugated, and deformed with cicatrices. The ovaria are ſurrounded by a ſtrong white membrane from the peritonæum, and are of membranous ſubſtance, fibrous, reticulated, and full of veſſels variouſly interwoven; they contain from ten to twenty, or more, pellucid eggs, which are ſuppoſed to contain the firſt rudiments of the fœtus; the largeſt of them is not ſo big as a pea. There are two arteries, and two veins, which paſs to and from the ovaries, or teſtes, in the ſame manner that they do, to and from the teſticles in men; but make more windings, and the arteries dilate more ſuddenly in proportion as they are ſhorter. Theſe arteries and veins detach branches into the uterus and Fallopian tubes, and not only make communications betwixt the artery and vein on one ſide, and thoſe of the other, but alſo with the proper veſſels of the uterus, which are detached from the internal iliac arteries and veins. Beſides the ſpermatic veſſels, the ovaria have nerves from the intercoſtals and lymphatics, which diſcharge themſelves into the common receptacle. The ovaria are connected to the fundus uteri, by means of the ligamenta rotunda; to the Fallopian tubes, and the ſides of the pelvis by the ligamenta lata, or veſpertilionis alæ; and to many other parts by means of the ſpermatic veſſels.

Tubæ Fallopianæ.

Tubæ Fallopianæ are two canals of a tortuous figure, but approaching to a conic form, are joined to the fundus uteri one on each ſide; one end of the tube is connected to the uterus and opens into its cavity; its orifice is ſmall, being about the ſize of a large hog's briſtle. The other end is much larger, and is fimbriated, or fringed round the edges, therefore called morſus diaboli; it is free, and fluctuates about the abdomen, and when there is occaſion, this extremity applies itſelf to the ovary, embracing it with theſe muſcular ſegments or fringes. Tho' the extremities of theſe tubes are ſmall, the middle, or wideſt part is about the ſize of one's little finger. Their length is about ſix, ſeven, or eight fingers breadth, different in different ſubjects; they are connected to the ovaria by the alæ veſpertilionis. Their ſubſtance is membranous and cavernous: they are compoſed of a double membrane, the exterior one ſeems to be continuous with the peritonæum, and the interior with the interior membrane of the uterus.

They are wrinkled on the inner ſurface, and are imbued with a lubricous humor; but they are not cellular in the human body as in other animals. They are furniſhed with a great number of veſſels, having the ſame veins, arteries, nerves, and lymphatics, as the ovaria: and have a cavernous ſubſtance between their membranes, by means of which they are rendered rigid in applying their mouths to the ovaria; they are alſo moiſtened on their inner ſurface by theſe veſſels. Their uſe in generation is very great; they become erect in the time of coition, from the influx of the blood and ſpirits, and at that time, by a natural motion, they apply their looſe fringed extremity to the ovaries, which are ſurrounded and embraced by them. In this ſtate they convey to them the prolific matter of the male ſemen injected into the womb; and after one of the ovula is impregnated, they receive and convey it to the womb. Cheſelden ſays, he hath ſeen in a woman both the Fallopian tubes unperforated, which upon the foregoing hypotheſis, muſt have cauſed barrenneſs, and ſeed lodged in theſe tubes may have the ſame effect; which he takes to be often the caſe of common whores, and women that uſe coition too frequently; and perhaps the fat in the membrane that connects the ovaria to the tubes, may, in very fat women, ſo keep theſe tubes from the ovaria as to interrupt impregnation; beſides theſe caſes, too much or too little of the menſes may deſtroy or interrupt conception; but the latter caſe, eſpecially in young women, is very rare. From ſuch cauſes as theſe, and not from imbecility, it is moſt probable that barrenneſs oftener proceeds from women than men; and though women do not propagate to ſo great an age as men, it ſeems not to be owing to an incapacity of being impregnated, but from their menſes ceaſing, and thoſe veſſels being cloſed which ſhould nouriſh the fœtus after the impregnation, as if on purpoſe to prevent the propagation of a feeble and infirm ſpecies. From this conſideration, it is reaſonable to ſuppoſe, that the perfection of the fœtus, notwithſtanding it is firſt formed in the male ſeed, depends more upon the female than the male, or elſe that nature would, for the ſake of the ſpecies, have been careful to hinder men as well as women from propagating in a declining age.

The ſeed of all animals, and particularly of mankind, is a whitiſh fluid ſecreted from the blood in the teſtes as above; in which Semen maſculinum.

Lewenhoeck, by the help of microſcopes, diſcovered an infinite number of animals like tadpoles, which he and others ſuppoſe to be men in miniature, and that one of theſe being entered into an egg in one of the ovaria, conception is performed.

SECT. III.

Of the EMBRYO and the FOETUS in UTERO.

Of the embryo.

FROM conception, until the egg hath been ſome five or ſix days in the uterus, it is almoſt impoſſible to deſcribe the changes it undergoes, upon the account of its minuteneſs, and for want of obſervations. After that time we may ſpeak of the matter with more certainty. The egg is then a round pellucid globule, of only one membrane, containing the embryo, which name it retains, before the ſeveral members are diſtinctly formed; after which period it is denominated a fœtus. The embryo hath a very large head, a ſmall body, and no legs or arms, ſwimming in a large quantity of a pellucid liquor; it hath then a large, flat umbilicus, by which it adheres to the obtuſe extremity of the egg. The proper membrane of the egg, called amnion, by degrees ſends off all around its ſurface ſmall flocculent veſſels, whereby it grows to thoſe veſſels of the uterus from whence the menſes were wont to flow before pregnancy. By degrees theſe flocculent veſſels, round the greateſt and inferior part of the egg, ceaſe to grow, degenerating into a ſecond membrane, called chorion; while thoſe veſſels at the upper and blunt end, keep increaſing in their diameters, and at length form the placenta deſcribed below. In the firſt two months, or at the end of that time, there appears not any thing bony, the ſeveral parts or members not being diſtinctly formed till the third month. The head is firſt perfected; the thorax or breaſt next; then the abdomen; and laſt of all the extremities.

Fœtus in utero.

Chorion and amnion.

The fœtus in utero, (ſo called after the parts are all diſtinctly formed) is involved in the ſame coats as the embryo, viz. the chorion externally, and the amnion interiorly, which immediately incloſes the fœtus. They contain a quantity of liquor, which is a proper medium for ſo tender a being as the fœtus to reſt in, and partly ſecures it from external injuries, as the aqueous humour does the chryſtalline in the eye; and when the membranes burſt in the time of birth, this humour lubricates the vagina, to render the birth leſs difficult.

Nutrition of the fœtus.

The manner of the nutrition of the fœtus in utero, hath been matter of much controverſy; the moſt reaſonable opinion, I think, is, that the fœtus is nouriſhed both by the mouth and by the umbilical veſſels, viz. during the firſt months, while the organs of concoction are not yet formed, it is probably nouriſhed by means of the navel-ſtring alone, (which paſſes out of the fœtus, to the placenta of the mother, deſcribed hereafter). But in the more advanced ſtate of the fœtus it is probably alſo nouriſhed by the mouth, by means of a ſoft and ſomewhat glutinous fluid, and which is probably ſecreted from the amnios; though Mr. Monro and ſome others are of a different opinion.

Allantois. As to the exiſtence of a third membrane named allantois, between the chorion and amnion, in the human fœtus as in brutes, it is almoſt univerſally denied, by the beſt anatomiſts.

Placenta. Placenta is a ſoft, roundiſh maſs, found in the uterus of pregnant women, which from its reſemblance to a cake, derives its name; and being alſo like the liver, was called by the antients hepar uterinum, or womb-liver. The number of placentæ in human ſubjects, anſwers to that of the fœtuſes; and as theſe are uſually ſingle, the placenta is uſually ſo too: but when there are two or more fœtuſes, there are always as many placentæ; yet in this caſe they often cohere together, ſo as to ſeem but one; but their veſſels do not communicate from one to the other. The placenta is uſually about ſix inches in diameter, and one inch thick in the middle, growing a little thinner towards the circumference; it is ſurrounded with a ſmooth membrane from the chorion and amnion, and its concave part is turned towards the fœtus; it has no particular part of the uterus to adhere to, but is uſually fixed to the fundus uteri. Dr. Thomas Simſon, of St. Andrew's, however, thinks that it has no place in the ovarium, nor in the uterus till once the ovum becomes contiguous to the fundus, and then every contiguous part becomes really a placenta.

The placenta is compoſed of the extreme branches of the umbilical vein and arteries, which are for the compoſition of this part divided into an infinite number of exceeding ſmall branches, to join a like number of the menſtrual veſſels of the uterus, which veſſels of the uterus are made numerous rather than large, that the ſeparation of the placenta from them may not be attended with a flux of blood fatal to the mother; for the ſides of little veſſels ſoon collapſe and cloſe, and they are more eaſily ſtopped, being compreſſed by the uterus itſelf as it ſhrinks, which it begins to do from the time of the birth; but when the placenta is ſeparated before the delivery, whether untimely or not, theſe veſſels bleed until the uterus is diſcharged of the fœtus.

The arteries and veins of the uterus, by which the menſtrual purgations are made, are joined to the umbilical arteries and veins in the placenta, the arteries of the uterus to the veins in the placenta, and the veins in the uterus to the arteries of the placenta: by theſe veſſels a large quantity of blood is continually flowing from the mother to the fœtus and back again. The navel-ſtring, or umbilical blood-veſſels, termed funiculus umbilicalis, paſſes out at the navel of the fœtus, to the placenta. It is commonly about two foot long, that the fœtus may have room to move without tearing the placenta from the uterus, which being done too ſoon, from whatever cauſe, occaſions a miſcarriage. This umbilical cord is compoſed of a ſpongy ſubſtance encloſing the blood-veſſels, viz. two arteries and one vein, twiſt about each other, particularly the arteries about the vein. The arteries ariſe from the internal iliacs of the child, and running up on each ſide of the bladder, perforate the belly where the umbilical vein entered. With the arteries and vein abovementioned, there alſo paſſes a veſſel called urachus, which ariſes from the top

Funiculus umbilicalis.

of the bladder. The umbilical veſſels, with the urachus, being ſhrunk up after the birth, looſe much of their appearance, eſpecially near the navel, where they are ſometimes not to be diſtinguiſhed. The umbilical vein goes from the navel directly to the liver, and there enters the great trunk of the vena portæ; it has its origin from ſmall venous tubuli, ariſing from the chorion, where the evaneſcent twigs of the arteries are loſt; and at length forming one large trunk, enters the umbilicus of the embryo, goes to the liver as before obſerved, and opens into the ſinus of the vena portarum. Near this entrance there goes out the ductus venoſus to the great trunk of the cava, which carries part of the blood that is brought by the umbilical vein that way into the cava, while the reſt circulates with the blood in the porta; the whole of it not paſſing through the ductus venoſus, as is generally believed, but a great part of it into branches of the porta, in the liver; otherwiſe there need be no communication between the umbilical vein and the porta. After the birth, when the umbilical vein is ſtopped, it becomes a ligament, and the ductus venoſus ſoon ſhrinks and almoſt diſappears, having no longer any blood flowing through it. The blood which flows from the mother to the fœtus by the umbilical vein is returned, all but a ſmall quantity, which is reſerved for nutrition by the two umbilical arteries.

Circulation to and from the fœtus and mother

The manner in which the blood flows from the mother to the fœtus, and from the fœtus to the mother, is as follows, viz. the uterine arteries in the mother bring arterial blood to the organ of the placenta in the egg; which being taken up by the beginning of the veins of the placenta, is tranſmitted to the fœtus, through the umbilical vein, into the vena portarum; and from thence into the cava and heart. And the two umbilical arteries in the fœtus being continued from the aorta, carry their blood to the placenta; which blood, at the adheſion of the placenta to the uterus, is taken up by the beginning of the uterine veins, and tranſmitted to the cava and heart of the mother; what was arterial in the one becoming venous in the other interchangeably: but the fœtus hath ſome peculiarities in its own proper circulation beſides.

Magnitude and weight of the embryo and fœtus in utero.

When the ovum deſcends into the uterus, it is ſuppoſed to be about the ſize of a poppy ſeed, and in the third month augmented to the bigneſs of a gooſe egg. Ten days after conception, the child (according to ſome authors) weighs half a grain; at thirty days, is increaſed to the weight of twenty-two grains; at three months, weighs betwixt two and three ounces; and at nine months, from ten to twelve, and ſometimes ſixteen pounds: by which calculation it would appear, that the progreſs of the fœtus is quickeſt in the beginning of its growth: for, from the tenth to the thirtieth day (according to this ſuppoſition) it increaſes to three and forty times its weight. But all theſe calculations are uncertain.

Diſtenſion of the uterus.

As the fœtus, &c. grows in bulk, the uterus is diſtended, but retains the ſame, or nearly the ſame, abſolute thickneſs; the blood-veſſels, which in its natural contracted ſtate lay folded and rolled together like threads in a clue, being ſtraitened out, now re-

receive blood more freely than before, and become of greater diameters. So that what the uterus loſes of thickneſs by diſtenſion, in its membranous or cellular parts, it gains by the enlargement of its veſſels. As it is gradually more and more diſtended, its fundus riſes more and more out of the pelvis up into the abdomen towards the colon and ſtomach, and being ſtretched in every dimenſion, creates the bulk we ſee in pregnancy.

Situation of the fœtus in utero.

The natural ſituation of the fœtus in utero for the laſt months of geſtation, (for before that time it is uncertain and various) is, as it were ſitting; with its head and neck bent downwards and forwards; its knees drawn up to its cheeks; its heels lying back toward its hips; and its hands hanging down, and as embracing its knees. But there is a great variety of poſtures of the fœtus, both before and at the time of delivery, as is ſhewn in midwifery.

Differences of a fœtus from an adult.

The more eſſential differences between the human fœtus ripe for birth, and an adult, appear to be as follows.

In the abdomen, the umbilical vein and arteries of the navel, and the canalis venoſus in the liver, are in the fœtus open and pervious; in adults they are contracted and ſolid. The liver is very large, the ſtomach is filled with a glutinous fluid; and the larger inteſtines, and often the ilium alſo, with the fæces called meconium. The renes ſuccenturiati are larger in the fœtus than in adults. The kidneys themſelves are not ſmooth and even on the ſurface, as in adults, but unequal, and in ſome meaſure reſemble thoſe of a calf. The urinary bladder is of a longer ſhape, and extends almoſt to the navel.

vel. The hymen in a female fœtus is very plain and obvious. In the thorax, beſides a pecular fluid, found as well in this cavity as in the abdomen, the gland thymus is larger than it is adults. The lungs, as they have never yet been inflated by breathing, are collapſed, and of a blackiſh colour; and if thrown into water they ſink in it, contrary to what is the caſe in adults, or thoſe that have breathed. In the heart, the foramen ovale between the left and right auricle, and the canalis arterioſus, between the pulmonary artery and the aorta, are open, to ſerve for a peculiar circulation in the fœtus, which has not yet breathed; and there is in the inferior trunk of the vena cava, near the heart, a remarkable valve, called by Cheſelden in his Anatomy, valvula nobilis. In the head, beſides its great ſize in proportion to the body, we are to obſerve, that the oſſa cranii are in ſeveral places diſtant from one another, eſpecially at the fontanella; and that the ſutures are wanting. The brain, alſo, is ſofter than in adults. The teeth are imperfect, and not rooted in the gums; they lie hid or buried under the gums, to appear at a more advanced period. The meatus auditorius is not yet perfect in them; and, in the fœtus, is entirely cloſed up by a peculiar membrane, which is continuous with the epidermis, and naturally diſappears after delivery. The bones of the whole body, excepting a very few, are either ſoft or abſolutely imperfect: ſome of them are merely cartilaginous, and the articulations are not at that time perfected.

S E C T. IV.

Of the Eye.

Of the eye. THE figure, ſituation, and uſe of the eyes, being well known, I need only deſcribe their internal parts, &c. not yet mentioned. For the bony ſocket, muſcles, cartilages, and ligaments of the external parts of the eye, ſee Chap. ii. but to thoſe parts already ſpoken of, may be added the glandulæ ſebaceæ, which are ſituated in the interior ſurface of the eye-lids: they ſerve for the ſecretion of an oleaginous fluid, which is of great uſe in preventing the attrition of the eye-lids, from their continual motion.

Glandulæ ſebaceæ.

Caruncula lachrymalis. Caruncula lachrymalis is a little eminence ſituated in the larger angle or canthus major of the eye, ſerving to direct the tears to the puncta lachrymalia, and, according to ſome anatomiſts, they help to keep them open when the eyes are ſhut.

Glandula lachrymalis. Glandula lachrymalis is ſeated in the upper and outer part of the orbit, with its excretory ducts under the upper eye lid. This gland ſeparates the matter of the tears, which, by the continual motion of this lid, furniſhes at all times water enough to waſh off duſt, and to keep the external ſurface of the eye moiſt, without which the cornea would dry and wrinkle by the continual action of the external air. As the tears fall off the cornea, they are ſtopped by the edge of the under eye-lid, along which they run till they fall into the puncta lachrymalia.

Puncta lachrymalia. Puncta lachrymalia are two ſmall holes in the inner corner or great canthus of the eye, one in each eye-lid; they are ſituated at the extremities of the tarſi or cartilages, and lead to a ſmall membranous bag or lachrymal ſac, which is ſeated in this corner upon the os lachrymale; from the bottom of which, there goes a ſmall pipe or naſal canal, which pierces this bone into the noſe, opening under the upper lamina of the os ſpongioſum. It moiſtens the inner membrane of the noſtrils, by the ſuperfluous humour of the lachrymal gland. Sometimes the acrimony of this humour cauſes ſneezing, which we may hinder, by preſſing the angle of the eye, and ſo ſtop its running. Between theſe two punctua there is a caruncle (as above mentioned) that ſerves to keep the holes open when the eyes are ſhut.

Orbit. The orbit of the eye, or cavity in which it is contained, is, in all the vacant places, filled with looſe fat, which is a proper medium for the eye to reſt in, and ſerves as a ſocket for its motion. The proper parts of the eye, which form its globe, eye-ball, or bulb, are its coats or tunics, the humors, and the veſſels.

Coats or tunics of the eye and humours. The coats or tunics of the eye are, albuginea, adnata, or conjunctiva, ſclerotica, cornea, choroides, and the uvea; to which may be added the retina, being a ſort of a mucous coat.

The humors of the eye are three; viz. the aqueous, vitreous, and chryſtalline; the two latter are ſurrounded by an extreme thin and fine vaſcular membrane, called tunica aranea or arachnoides.

Tunica albuginea adnata or conjunctiva.

The firſt membrane or coat of the eye, is the albuginea, adnata, or conjunctiva. This is a ſmooth membrane, which covers ſo much of the eye as is called the white, and being reflected all round, lines the two eye-lids. Being thus returned from the eye to the inſide of the eye-lids, it effectually hinders any extraneous bodies from getting behind the eye into the orbit, and ſmooths the parts it covers, which makes the friction leſs between the eye and the eye-lids. It is full of ſmall veins and arteries, which appear big in an ophthalmia or inflammation of the eyes.

Tunica ſclerotica.

The ſecond coat is called ſclerotica; it is thick, hard, and ſmooth, and extended from the cornea to the optic nerve; it is opake behind, but tranſparent before; where it makes the third coat called cornea. Both together make one firm caſe of a proper form for the uſe of the other coats and humors.

Cornea.

Cornea, ſo called from its ſubſtance reſembling the horn of a lanthorn, is convex, tranſparent, and compoſed of various laminæ, which are nouriſhed by many blood-veſſels, ſo fine as not even to hinder the ſmalleſt rays of light from entering the eye. The cornea is ſituated in the forepart of the eye, ſurrounded by the ſclerotica and albuginea; it has a moſt exquiſite ſenſe, to the end that the tears, upon the leaſt pain, may be ſqueezed out of the lachrymal gland, to waſh off any filth, which, by ſticking to the cornea, might render it opake or dim.

Tunica choroides.

The fourth coat of the eye is the choroides, ſo named, on account of the multitude of blood-veſſels reſembling the chorion; it lies immediately under the ſclerotica, and is much thinner than it, being a membrane of little firmneſs. It is blackiſh, or of a duſky brown colour, more or leſs inclining to red. This membrane, or coat, has a great number of blood-veſſels which come from the ſclerotica. It is open, or has a hole before, for the paſſage of the rays of light, called pupilla; the part of this coat, which makes the circumference of the hole, and lies upon the ſide of the chryſtalline humor, is the uvea.

Uvea. The fifth coat is the uvea, which is only a white circle round the back ſide of the choroides near the cornea, as has been ſaid.

Iris. In this coat we obſerve, firſt, the iris, which is a circular variouſly coloured part, being the anterior ſurface of the uvea, which ſurrounds the pupil; it is called the iris, becauſe in different perſons it is of different colours; hence the denomination of grey, blue, brown, haſel, black eyes, &c. each of which has its peculiar beauty, and is ſuited to the complexion of the perſon. The iris is entirely vaſcular, from which ariſes the variety of colours in the human eyes.

Pupilla. Secondly, the pupil, or foramen, which is round in the human eye, nearly in the middle of the iris, and is capable of dilatation and contraction. Through this aperture, the rays of light paſs to the chryſtalline, in order to be painted on the retina, and cauſe viſion. Thirdly, its poſterior ſurface, which is black, and in which, when this blackneſs is cleared away, there appears the ſphincter of the pupil, formed of circular fibres for contraction; the ciliary fibres, or proceſſes, for the dilatation of the pupil; the ciliary ligament for the motion of the vitreous and chryſtalline humors; the arterial and venal circles, from which the veſſels are in a wonderful manner diſtributed over the uvea; the choroides; the ligamentum ciliare; and the vitreous and chryſtalline humors; the ductus nigri, ſo called from their black colour, placed between the proceſſes and the ligamentum ciliare; the ſpace between the uvea and the cornea, called the anterior camera of the eye; and that between the uvea and chryſtalline, called its poſterior camera, which is either much ſmaller, or entirely wanting. Many authors have attributed glands to the uvea, but they are very difficult to be diſtinguiſhed, if there be any.

Retina.

The ſixth membrane or tunic is the retina, which lies immediately under the tunica choroides, and is a very delicate, tender, and as it were, mucous coat of the eye; or more properly, it is only an expanſion of the optic nerve at the bottom of the eye. It is a primary part of the eye, and the great organ of viſion, for the ſake of which all the reſt were formed. It is called retina becauſe it ſomewhat reſembles a net: rays of light ſtriking upon this membrane, the ſenſation is conveyed by the optic nerves to the common ſenſorium, the brain.

The aqueous humor of the eye.

The humors of the eye are three, as hath been ſaid; the firſt is called the aqueous, and lies in the fore-part of the globe, immediately under the cornea: this humor is thin and liquid, of a ſpirituous nature, for it will not freeze in the greateſt froſt. This evinces the neceſſity of a continual ſupply of this humor; which is manifeſt it hath, becauſe if the cornea be pricked, and this humor ſqueezed out, it will be again reſtored in ten or twelve hours: this aqueous humor lying foremoſt, ſeems chiefly of uſe to prevent the cryſtalline from being eaſily bruiſed by rubbing, or a blow; and perhaps it ſerves for the cryſtalline humor to move forward in, while we view near objects, and backward for remoter objects.

Cryſtalline humor.

The ſecond humor is the cryſtalline, diſtinctly contained in a very fine coat or membrane, called aranea, or arachnoides, and is ſuſpended by means of the ciliary ligament, between the aqueous and vitreous humor, immediately behind the pupil; in this place it hangs free, and is moveable by means of the ligament juſt mentioned. It is compoſed of a multitude of lamellæ, like the coats of an onion; and therefore alſo pellucid and vaſcular. There is alſo a ſmall quantity of the aqueous humor contained within or under its coat. The cryſtalline being a thick, compact humor, in form of a flattiſh convex lens, ſituated in the middle of the eye, ſerves to make that refraction of the rays of light neceſſary to make them meet in the retina, and form an image thereon, whereby viſion may be performed.

Vitreous humor.

The third humor is the vitreous or glaſſy humor, ſo called from its reſemblance to glaſs in fuſion, being very like a fine clear jelly in appearance; it is thicker than the aqueous, but thinner than the cryſtalline; and is in greater abundance than the other two. It lies behind the cryſtalline, and fills up the greateſt part of the eye: its fore-ſide is concave for the cryſtalline humor to lodge in, and its back-ſide being convex, the tunica retina is ſpread over it; it ſerves as a medium to keep the cryſtalline humour and the retina at a due diſtance.

Veſſels, &c. of the eye.

The eye is furniſhed in a moſt wonderful manner with nerves and blood-veſſels, in all its parts. The blood-veſſels are branches of the carotids and jugulars, ſee Chap. ii. diſtributed to all parts of the eye in an amazing manner. The extreme minute ones convey only a fine and ſubtile lymph thither, by which means the tunics and humors of the eye are nouriſhed; the veins partly carry the blood back to the ſinuſes of the dura mater, and partly to the jugulars. The nerves of the eye are very numerous: beſides the optic nerve, there are the third and fourth pair of the brain. The optic nerves, deſcribed in Chap. ii. Sect. 7. pierce the globe of the eye from the ſide of the noſe, a little on the inſide of the optic axes or center. Their external coat, which is a production of the dura mater, is continued to the ſclerotis, as their internal is from the pia mater to the choroides: and the medullary fibres paſſing through all, are expanded on the retina, upon which the images of objects are painted. The centre of this expanſion is inſenſible, and all rays which fall upon it are loſt; conſequently, that point of the object from which the rays come, is inviſible to the eye. The reaſon of this proceeds, probably, from the blood-veſſels, which enter the globe of the eye with the optic nerve, and cover this part of the retina. But whatſoever the cauſe be, there is a manifeſt advantage in the optic nerves being inſerted on the inſide of the optic axis. For if they had pierced the eye in the axis, the middle point of every object had been inviſible; and where all things conduce to make us ſee beſt, there we had not ſeen at all. We muſt, likewiſe, have loſt ſome part of the object, if the optic nerves had been placed on the outſide of the optic axis: becauſe an object may be ſo placed, as that all the rays which come from one point, may fall upon the outſide of both eyes: but it is impoſſible they ſhould fall upon the inſide of both eyes; therefore that point which is loſt in one eye, is viſible by the other. Innumerable authors have wrote upon the eye and viſion, therefore the reader that deſires to be more fully informed may conſult the following. Winſlow's Anatomical Deſcription of the Eye is drawn up with his uſual accuracy. Le Cat is very copious upon viſion; but when he would ſeem to underſtand colours and refraction better than Sir Iſaac Newton, he will ſcarce gain your aſſent. The writers of courſes of experimental philoſophy, the chief of which are Graveſend, and Muſchenbroek (for Deſaguliers omits optics) treat at large of the eye and viſion; to which Rutherforth, and Dr. Smith, who hath wrote a complete ſyſtem of optics, may be joined; and Dr. Porterfield's Treatiſes upon the Motions of the Eye, in the Edinburgh Medical Acts are excellent.

SECT. V.

Of the EAR.

THE figure and ſituation of the outer ear need no deſcription, being already ſpoken of; and for the bones, muſcles, and cartilages, ſee their reſpective ſections in Chap. ii. Its inner ſubſtance is cartilage, as as hath been ſaid, which preſerves its form, with- Of the ear.

without being liable to break: its uſe is to collect ſounds, and direct them into the meatus auditorius, which is the paſſage that leads to the drum. Hence thoſe who have loſt their ears, hear not ſo acutely as others; and endeavour to ſupply that want by applying the palm of their hand made hollow to their ears. Hence the uſefulneſs of hearing trumpets.

Meatus auditorius. The meatus auditorius, or paſſage of the ear, leads to, and terminates in the membrana tympani, or drum of the ear. It is near an inch long, and about the fourth part of an inch wide; and its paſſage is not ſtrait but crooked, paſſing firſt upwards and then downwards, when it has a ſmall tendency upwards again, and the lower part of its extremity bends a little down to the obliquity of the membrana tympani. The beginning of this paſſage is cartilaginous, being a continuation of the concha contracted; the end of it is bony, which makes the greateſt part of the upper and back-part of the meatus, as the cartilage does of the lower and fore-part. The whole internal cavity of the meatus is lined with a membrane, which ſeems to be a continuation of the ſkin that covers the auricula, and which grows thinner and thinner as it approaches the tympanum. On the back-ſide of this membrane there is a great number of little glands, whoſe excretory ducts bring into the meatus a yellow excrement called cerumen or wax of the ear, **Cerumen.** whoſe bitterneſs and viſcidity, together with the hairs in this membrane, hinders inſects from approaching the membrana tympani, which it likewiſe preſerves againſt the injuries of the air. When this wax is accumulated in too great quantity, it obſtructs the meatus, by filling up the paſſage, and creates the moſt common kind of deafneſs; the remedy of which is picking the ears, or ſyringing them. Thoſe great diſcharges of matter from the meatus auditorius which are commonly called impoſthumes in the ear, ſeem to be nothing elſe than ulcerations or great ſecretions from theſe glands.

Membrana tympani. The membrana tympani lies at the inner extremity of the meatus; it is extended upon a bony ridge or circle of the temporal bone. This is an oval membrane; thin, dry, firm, and tranſparent: though it ſeems ſtretched pretty tight, yet it is not plain, but concave outwardly toward the meatus, and inwardly convex; being pulled inward by the handle of the malleus which is tied to it. This membrane does not entirely cloſe the paſſage, but has on one ſide a ſmall aperture covered with a valve, letting the ſmoke of tobacco taken in at the mouth find a paſſage through it out at the ears.

Tympanum The tympanum or drum of the ear, is a pretty large cavity, ſituated behind the membrana tympani; it is about the fourth part of an inch deep, as much wide, and about half as high. In very young children it is always found full of mucus or a purulent matter, which ſeems neceſſary to prevent ſounds from affecting them too much, there being no proviſion to ſhut the ears, as there is for the eyes. Cheſelden gives an account of a gentleman who had four children born deaf, on which, he was adviſed to lay bliſters upon the heads of the next children he might have, which he did to three who were born afterward, and every one of them heard well. It ſeems not unreaſonable to ſuppoſe that too great a quantity of this mucus upon the drum might be the cauſe of deafneſs in the four children, and that the diſcharge made by the bliſters in the latter caſes was the cauſe of their eſcaping the ſame misfortune. In this cavity are to be obſerved the perioſteum, which lines it, a very thin membrane, and furniſhed with a great number of blood-veſſels; the chorda tympani, being a little nerve compoſed of a combination of little branches of the fifth and ſeventh pairs. This is extended in the manner of a cord, under the membrana tympani. In this cavity alſo, there are four ſmall bones already deſcribed in Chap. ii. Sect. 2. of which the firſt is the malleolus or hammer, ſo called becauſe of its ſhape; its manubrium or handle, which is pretty long and ſmall, is faſtened to the membrane of the tympanum as hath been ſaid, and its head is articulated by ginglymus with the body of the incus; which bone is articulated by arthrodia with the ſtapes, and the orbiculare lies between. The malleus is moved inward by the muſculus obliquus internus, or trochlearis, or internus mallei; it extends the membrana tympani that it may be the more affected by impulſe of ſounds when they are too weak. This muſcle ariſes from the cartilaginous part of the Euſtachian tube, and paſſing from thence in a proper groove, it is reflected under a ſmall proceſs, and thence paſſes on perpendicular to the membrana tympani to be inſerted into the handle of the malleus, ſometimes with a double tendon. Parallel to this muſcle lies another extenſor of the membrana tympani, called obliquus externus or externus mallei; but this is not ſo obviouſly

Chorda tympani.

Officula auditus, &c.

an extenſor as to be known to be ſo without an experiment. The muſcle which relaxes the membrana tympani is called externus or laxator tympani. The relaxation of the membrane is made by this muſcle, without our knowledge, when ſounds are too ſtrong; and as the pupil of the eye is contracted when we have too much light, and dilated where there is too little, from what cauſe ſoever, ſo when ſounds are too low, or the ſenſe of hearing imperfect, from whatever cauſe, the extenſors of the tympanum ſtretch it to make the impulſe of ſounds more effectual upon it, juſt as in the caſe of the common drum, and the cords of any muſical inſtrument.

Tuba Euſtachiana.

From the tympanum, (which cavity is called alſo the barrel of the ear) goes the Euſtachian tube, or iter ad palatum. The beginning of this paſſage is very narrow and bony, the middle is cartilaginous, and its extremity, which opens into the back part of the noſtrils, juſt above the uvula, is about the third part of an inch wide, membranous, and dilated by ſome muſcular fibres; they dilate the extremity of this paſſage, either when we open our mouths to hear more diſtinctly, or when it is neceſſary there ſhould be a free communication between the external air, and that in the cavity of the tympanum. This paſſage, therefore, ſeems to be exactly of the ſame uſe with the hole in the ſide of the common drum, that is, to let the air paſs in and out from the barrel of the ear to make the membrane vibrate the better, and, perhaps, in the ear, which is cloſer than a common drum, to let air in or out as it alters in denſity, and if any fluid ſhould be ſeparated in the barrel of the ear, to give it a paſſage out. This paſſage being obſtructed, as it is ſometimes, by a large polypus behind the uvula, it cauſes great difficulty of hearing, and ſometimes, when the meatus auditorius is obſtructed, a man opening his mouth wide, will hear pretty well through this paſſage, which is often ſo open, as that ſyringing water through the noſe, it ſhall paſs through into the barrel of the ear, and cauſe deafneſs for ſome time. To the ſtapes, there is one muſcle called muſculus ſtapedius; it ſerves to pull the ſtapes from off the feneſtra ovalis, which otherwiſe it covers.

Foramina veſtibulum and labyrinth.

Beſides the Euſtachian tube already deſcribed, there are in the cavity of the tympanum three holes, leading to the cavity called veſtibulum; which forms the middle part of the labyrinth, or innermoſt cavity of the ear, termed a labyrinth, from its ſinuoſities and windings.

Feneſtra ovalis.

The firſt of theſe holes is called feneſtra ovalis; to which, as hath been ſaid, the baſe of the ſtapes is fixed, and completely ſtops it.

Rotunda.

The next is the feneſtra rotunda; and the other leads into the cavity of the maſtoide proceſs. After theſe may be obſerved three ſemicircular canals, which open into the veſtibulum by five orifices.

Cochlea.

The cochlea of the ear is placed oppoſite to theſe canals, and is in the manner of a ſnail-ſhell, forming two turns and a half in a ſpiral form. In this are to be remarked the nucleus and the canal, which is divided into two, by a ſpiral lamina: the upper of theſe opens into the veſtibulum, and is called the ſcala veſtibuli, and the lower, which terminates in the hollow of the tympanum, thro the feneſtra rotunda, is called ſcala tympani. The two holes, called feneſtra ovalis and rotunda, are cloſed with a fine membrane like the membrane called the drum, and the larger being occaſionally covered and uncovered by the ſtapes, ſounds are thereby made to influence more or leſs, as beſt ſerves for hearing; and this advantage being added to that of a lax or tenſe tympanum, the effect of ſounds may be greatly increaſed or diminiſhed upon the auditory nerves, expanded in the labyrinth. In the ſtrongeſt ſounds, the membrana tympani may be lax, and the feneſtra ovalis covered; and for the loweſt, the membrane tenſe and the feneſtra uncovered.

Membrane of the labyrinth the organ of hearing.

A very delicate and fine membrane, carried along through the cavities of the labyrinth, is formed of an expanſion of the auditory nerve, and is the primary part of the organ of hearing, juſt as the retina is formed of the expanſion of the optic nerve, and is the primary organ of ſeeing. Next may be obſerved the auditory canal, which is diſtinguiſhed into the common and proper; the common is large, and has foraminula in it, paſſing into the labyrinth; the proper one is narrow and longer, terminating partly in the cavity of the cranium, and partly between the ſtyloide and maſtoide proceſſes.

Veſſels, &c. of the ear.

The arteries of the ear are from the carotids, both external and internal; the veins run partly to the jugulars, and partly to the ſinuſes of the dura mater; the nervus auditorius enters by the hole in the internal proceſs of the os petroſum. It conſiſts of two bundles, of which one is hard, the other ſoft. Five branches of the portio mollis enter the veſtibulum, and form a delicate web, which ſends ſlips that run through the ſemicircular canals; the reſt of the portio mollis enters the cochlea at the center of its baſe, and turns with the ſpiral line, of which it probably makes the membranous part. The portio dura paſſes through its proper paſſage, to be diſtributed among the external parts about the ear.

There have been inſtances of the tympanum being deſtroyed by an ulcer, and the auditory bones caſt out, without deſtroying the hearing. From which, and other like caſes, it may be concluded that the membrana tympani, though uſeful in hearing, is not the ſeat of that ſenſe, and if any diſeaſe in that membrane ſhould obſtruct the paſſage of ſounds to the internal parts of the ear, which are the ſeat of that ſenſe, an artificial paſſage through that membrane might recover hearing, as the removing the cryſtalline humor, when that obſtructs the light, recovers ſight.

Deafneſs, treatment of.

In all complaints of deafneſs, the practitioner ought carefully to examine the ſtate of the ear; and learn whether the patient has, or hath had any abſceſs in the external meatus of the ear affected, that might have eroded the membrane of the tympanum; and he ſhould try whether it is ſound or not. This is done by holding a lighted candle to the affected ear. And if upon a ſtrong effort of exſpiration determined towards the ears, by ſtopping the mouth and noſtrils, the flame of the candle is ſenſibly acted upon, we may conclude the membrane of the tympanum to be broken, and the hearing by that ear irrecoverably loſt; for the cold air gets directly through the breach into the cavity of the tympanum, and by chilling and drying the delicate perioſteum of the little bones, the membranes of the cavity, and the ſmall muſcles, renders the parts unfit for performing their functions. If the wax is hardened, or even ſtony, drop in ſome oil of almonds over night, quickened with a very ſmall proportion of chemical oil of anniſeeds or amber; and the next morning, inject with ſoap ſuds and a little tincture of myrrh or traumatic balſam, made milk-warm or ſomewhat warmer. Injections are to be puſhed in gently, not to hurt the membrana tympani. If there is an abſceſs in the external meatus, it ought to be healed as ſoon as poſſible, that the pus may not at length affect the tympanum. For the diſeaſes of the ear, the reader may conſult Duverney: and on the organ of hearing and ſounds, the following authors; where he will find ample information.

Merſennus in his book De Harmonicis, and Kircher in his Muſurgia and Phonurgia, have treated copiouſly of ſounds and ſounding inſtruments. Writers on experimental philoſophy, the chief of whom are Graveſende, Deſaguliers, and Muſchenbroeck, likewiſe handle this ſubject. Helſham's Lectures are an excellent epitome; and Schellamer de Auditis contains almoſt what is ſufficient of this doctrine, as far as an account of the organ of hearing is concerned.

SECT. VI.

Of the SENSES of SMELLING, TASTING, and FEELING.

Senſe of ſmelling.

THE principal organs of ſmelling are the noſtrils, and the olfactory nerves. Though the parts of the noſe are already deſcribed in the foregoing ſheets, it may not be improper here to take a view of the whole together. The external parts of the noſe are well known, therefore need no deſcription. The internal parts are, the bones, muſcles, cartilages, veſſels, &c. See their reſpective Sections. The cartilages, which form the lower part, are connected by membranes, in order to render it flexible; the firſt of theſe form the anterior part of the ſeptum narium; there are two very large and conſpicuous ones in each of the alæ, and between theſe there are placed ſometimes two, ſometimes three, and ſometimes more ſmaller ones. The ſeptum narium is cartilaginous in its anterior and lower part; in its poſterior and upper it is bony; and theſe parts are ſurrounded by robuſt and ſtrong membranes, which join them firmly together.

There are two paſſages from the noſtrils into the mouth, deſtined for the paſſage of air and of the mucous matter: there are ſinuſes in the maxillary, frontal, and ſphenoidal bones; and cellulæ in the os æthmoides, which increaſe the hollow of the noſe, and thus gives room for the greater expanſion of the pituitary membrane. There are alſo certain inequalities and eminences of the os ſpongioſum of the noſtrils, which ſerve partly the ſame purpoſes, and partly to prevent inſects and other extraneous matter, and even the cold air from getting immediately that way into the mouth. There is likewiſe a ſoft and vaſcular membrane, which inveſts and lines the noſtrils, and all the ſinuſes and irregularities; this is called the membrana mucoſa, and pituaria of Schneider, and is the primary organ of ſmelling, and the place of ſecretion of the mucus of the noſtrils. This membrane in general is of a porous ſpongy texture, unequally thick in different places. Beſides the nerves that are diſtributed over it, and its blood-veſſels, it abounds with with glands, which ſeparate a mucous fluid, to be poured out upon its ſurface, partly through cylindrical excretory ducts, partly from round folliculi, opening into it without ducts. This mucus, which is formed in great plenty over the whole ſurface of the membrane, ſerves to defend the bare nerves from the injuries of the air, and, at the ſame time preſerves it moiſt and ſtops the exhalation or effluvia of odoriferous bodies, which make their impreſſions upon the olfactory nerves that are ſpread upon it, and whoſe minute ramifications or evaneſcent branches are expanded on its whole ſurface. There are ſeveral ducts or conduits, which open between the laminæ of the os ſpongioſum and cribiforme into the noſtrils. The firſt and ſecond are the ductus lachrymales; the third and fourth come from the ſinus frontalis; the fifth and ſixth from the nut of the ſecond bone of the upper jaw; the ſeventh and eighth from the cells of the os ſpongioſum;

oſum; they pierce the membrane which cover the firſt or uppermoſt lamina; and the ninth and tenth come from the ſinus in the os ſphenoides; for theſe ſinuſes, &c. conſult the index. All theſe ducts carry the liquor, which is ſeparated in their cavities, into the noſtrils, for the moiſtening its membranes which otherwiſe would dry too much by the air breathed through the noſtrils. They are all lined with the ſame membrane, by which contrivance the organ of ſmelling is vaſtly enlarged.

The arteries of the noſe, which are diſperſed in prodigious numbers through the pituitary membrane, ariſe from the carotids; theſe alſo ſerve for the ſecretion of mucus. The veins are from the jugulars, by which the abundant blood not employed for theſe purpoſes, is returned. For an effectual method to ſtop an hæmorrhage of the noſe, ſee my Marine Surgeon, &c. It is certain, that there is no paſſage to the brain for the air, much leſs for the powders ſnuffed up the noſtrils: and whether there be any for tranſmitting a mucous humour from the brain, in order to its being diſcharged at the noſtrils, as the ancients, and ſome others of the moderns have ſuppoſed, is not yet aſcertained.

The act of ſmelling is performed by means of odorous effluvia, floating in the air, being drawn into the noſtrils, in inſpiration, and ſtruck with ſuch force againſt the fibrillæ of the olfactory nerves, which the figure of the noſe, and the ſituation of the little bones, render oppoſite thereto, as to ſhake them, and give them a vibratory motion; which action, being communicated thence to the ſervoſenſorium commune, occaſions an idea of a ſweet, or fœtid, or ſour, or an aromatic, or a putrified object, &c. Brutes in general have a more exquiſite ſenſe of ſmelling than men; their noſes being more full of lamellæ; and the paſſage for the air being narrow and crooked, few of the effluvia eſcape one place or another; beſides, their olfactory nerves may be more ſenſible. Fiſh, though they have no noſes yet by their mouths, as Cheſelden obſerves, they may taſte the effluvia in the water, there being more nerves diſpoſed in their mouths, than through their whole bodies beſides, the optic excepted; but their taſte is not ſo exquiſite as in land animals. The freſher the bait, the more the effluvia; which is what entices them to take it, and not the taſte.

Some give an account why the ſmell of bodies, which conſiſt of acrimonious parts, draws tears from our eyes; and why the want of taſte does ordinarily accompany the want of ſmelling, by the communication of the branches of the fifth pair of nerves, which are diſtributed through thoſe organs of ſenſation.

Some odours are medicinal, and ſome poiſonous. The effluvia of wine and ſpirits have been found to inebriate. There have been inſtances of aloes and colocynth operating as cathartics by ſmell; but perhaps that might be owing to imagination. The fumes of kindled brimſtone and charcoal, when confined in a room or within a cloſe place, prove deadly. The effluvia of wine fermenting in a large caſk, if directed ſtrongly through a ſmall hole upon the lungs, are the moſt ſuddenly deſtructive of all known poiſons.

ſons. Mineral damps have often killed miners; and poiſons have been conveyed with too certain effects, in the way of odour.

Senſe of taſting.

The ſenſe of taſting is a peculiar ſenſation excited by means of the nervous papillæ of the tongue. It is only the upper part, or dorſum, and the marginal brim of the tongue, that perceives taſtes. This is evinced by touching any other part within the mouth by the moſt ſapid bodies, ſuppoſe ſalt; which application excites no ſenſe of taſte. The immediate organ of taſte is nervous papillæ, on theſe parts of the tongue I have juſt now mentioned, covered over with a mucous and almoſt tranſparent membrane. Theſe papillæ are larger and more conſpicuous than any other in the body. There are found three different kinds of them: one bigger and harder than the reſt, which poſſeſſes chiefly the back or upper part of the tongue: theſe are of a duller ſenſation than the other. The ſecond are of an oval figure, leſs, and more tender than the former: they are ſcattered over the upper part of the tongue, and the nearer they approach to its apex, or point, the more like they become unto the third ſort, which is by far the moſt numerous and ſmalleſt. They are diſſeminated amongſt the reſt, and are of a conical figure, and the moſt accutely ſentient of all, conſtituting the principal part of the organ of taſte; eſpecially ſuch of them as are at, or near the point of the tongue, where that ſenſe is moſt acute.

When we are to taſte, we endeavour, if the object is ſolid, firſt to comminute it by maſtication: then the ſaliva, or whatever juice the mouth affords, is poured out upon the comminuted molecula, and mixed with it. This being done, the papillæ are erected, and the thing to be taſted is preſſed againſt the upper part of the tongue, where the papillæ are placed, by thruſting it againſt the roof of the mouth. The erection of the papillæ in taſting, may be ſeen with attention by the aſſiſtance of the microſcope. If the tongue and mouth be quite dry, we cannot taſte at all, for want of moiſture to diſſolve the ſapid particles. The varieties of taſte are infinite in number: which are ſo well known as to need no comment in this place. The tongue is ſupplied with nerves from a branch of the fifth pair.

Herbivorous animals, which have a variety of alimentary vegetables ſpread before them, with noxious ones intermixed, are furniſhed with long tongues; and therefore a larger taſting ſenſory, with a more exquiſite ſtructure of papillæ, which man, who may ſubſiſt upon a leſs variety of aliments, and is endowed with reaſon to enable him to profit by admonition and experience, hath not the ſame occaſion for.

Senſe of feeling.

Feeling is alſo one of the five external ſenſes; the other four are already ſpoken of. By feeling, we obtain the ideas of ſolid, hard, ſoft, rough, hot, cold, wet, dry, and other tangible qualities. This ſenſe is the coarſeſt, but at the ſame time, the ſureſt of all others: it is beſides the moſt univerſal. We ſee and hear with ſmall portions of our body, but we feel with all. Nature has beſtowed that general ſenſation wherever there are nerves, and they are every where, where there is life; were it otherwiſe, the parts diveſted of it might be deſtroyed without our knowledge. I have before obſerved, in the introduction to this work, that the ſkin or cutis vera is plentifully ſupplied with nerves as well as blood veſſels, ſee Euſtachius's Tables, fig. 21. and fig. 23. where they are delineated.

The nervous papillæ defined.

Theſe nerves being branched out, and diſperſed over every phyſical point of the ſubſtance of the ſkin, render it extremely ſenſible. Their ultimate filaments are collected into ſmall bundles on the outer ſurface of the ſkin, immediately under the epidermis, form what anatomiſts call papillæ, that is, little nipples, ſuppoſed to be found over the whole ſurface of the ſkin, but much more conſpicuous in ſome places than others; and theſe papillæ are deemed the immediate organs of feeling. They are higher and more numerous in the palms of the hand, the ſoles of the feet, and in the toes and fingers, eſpecially the extremities of the latter. Hence the ſenſe of feeling is there quickeſt and moſt diſtinct. The perſpirable matter, conſtantly gliding over theſe papillæ, preſerves them moiſt, and in a fit condition to exerciſe their functions, as hath before been obſerved: and the inſenſible epidermis being ſpread over them, like a covering, and interpoſed between the ſkin and the bodies touched or felt, prevents the ſenſe from being too exquiſite and uneaſy, or painful, as it actually becomes, when that is rubbed off. In feeling nicely any object, in order to examine its properties by the touch, we gently and attentively rub the points of our fingers over it; whereby the papillæ being affected, convey to the ſenſorium commune the idea of hardneſs or ſoftneſs, ſmoothneſs or roughneſs,

neſs, equality or inequality; but heat and cold, dryneſs and moiſture, are perceived by barely touching without rubbing. It is not improbable, that in nice microſcopical examinations, the papillæ are erected, as may be concluded by analogy, from what has been obſerved in the organ of taſte. And Malpighius imagined he actually ſaw that erection in the papillæ of the fingers with a microſcope.

Theſe nervous papillæ ſerve only to the perfection of feeling, and to diverſify ſenſation; their ſtructure being not abſolutely neceſſary to it: for the lips of a freſh wound, the perioſteum, and the tendons, when uncovered, are extremely ſenſible without them; but it was neceſſary for the perfection of feeling, that the nerves ſhould form theſe ſmall eminences, becauſe they are more eaſily moved by the impreſſion of bodies, than an uniform ſurface, and it is by means of this ſtructure, that we are enabled to diſtinguiſh not only the ſize and figure of bodies, their hardneſs and ſoftneſs, but alſo their heat and cold. All the nervous ſolids, while animated by their fluids, have this general ſenſation of feeling, which is the baſis of all other ſenſations; and is ſo uſeful, that it ſupplies the office of the eyes, and in ſome ſenſe indemnifies us for their loſs; a very remarkable living inſtance of this there is now in this county (Cornwall) of one John Yates, in the pariſh of St. Iſſey near Padſtow, an exceeding ingenious mechanic, &c. Another remarkable inſtance was the late celebrated profeſſor at Cambridge; and Des Piles informs us of a blind ſtatuary, who by feeling curiouſly any face, could make a buſt bearing a ſtriking reſemblance to it.

Itching. Itching is a ſenſation occaſioned by ſome cauſe irritating theſe papillæ above mentioned, as perſpirable matter obſtructed, tickling the ſkin with a feather, &c. which provoke us to rub the part, and remove what is troubleſome. This ſenſation, when exceſſive, is perhaps more intolerable than almoſt any other, and capable of bringing on univerſal convulſions.

Pain. Pain is cauſed by whatever ſo affects the nerves as to endanger their deſtruction, whether by diſtraction, cutting, eroſion, burning, or otherwiſe. The ſenſe of feeling in general is given us, that we may avoid whatever has a tendency to ruin our bodies.

SECT. VII.

Of the CHYLE, and CHYLIFICATION.

Of the chyle. CHYLE is a milky fluid, ſecreted from the aliments by means of digeſtion. The principles of the chyle ſeem to be ſulphureous, mucilaginous, ſaline, and aqueous. It is a kind of natural emulſion, both with regard to the colour, the ingredients, and the manner of preparation. There is this difference between the artificial and natural emulſion, that the latter is far more pure, and is prepared with much greater apparatus, not by the ſudden expreſſion of part of the liquid, but by a gentle and ſucceſſive percolation. The chyle is made ſooner or later, according to the difference of the temperaments, ſtrength, aliments, and cuſtoms:

therefore, how many hours chylification requires, cannot be certainly determined. When the chyle enters the villous oſcula of the lacteals, it is not a fluid extracted merely from the aliment and drink, but a mixture of ſeveral fluids; that is, the ſaliva and thinner mucus of the mouth, and the two fluids of the œſophagus, one proceeding from the villous membrane of the tube itſelf, the other from its glands. To theſe may be added, the glutinous fluid of the ſtomach, the pancreatic juice, and the fluid of Peyer's glands, which are very numerous in the ſmall inteſtines. Hence the reaſon appears, why men may live upon bread and water, why the oriental nations uſe rice in the room of all kinds of pulſe; and why acids, ſpirituous liquors, ſaline things, and many vegetable juices, herbs, roots, and aromatic ſubſtances, are the leaſt fit to generate chyle. Some of the ancients ſuppoſed the chyle was changed into blood in the liver; others in the heart: but the moderns, with more reaſon, take the change to be effected by the blood itſelf, in all the parts of the body. See the next Section, Of the Blood, &c.

Of chylification.

Chylification is the formation of the chyle, or the act whereby the food is changed into chyle. Chylification commences by comminuting the aliment in the mouth, mixing it with ſaliva, and chewing it with the teeth; by theſe means the food is reduced into a kind of pulp, which, being received into the ſtomach, mixes with the juices thereof; and thus diluted, begins to ferment and putrify, and aſſuming a very different form from what it had before, grows either acid or rancid. Here it meets with a juice ſeparated from the blood by the glands of that part, whoſe excretory ducts open into the cavity of the ſtomach: by the commixture of theſe liquors, whether of ſaliva, or the juice of the ſtomach, a proper menſtruum is compoſed, by which the parts of the aliment are ſtill more and more divided by its inſinuating into their pores, acquire ſtill a greater likeneſs to the animal fluids, and form what is called chyme. The ſtomach, by means of its muſcular fibres, contracting itſelf, gradually diſcharges its contents by the pylorus into the duodenum; in which gut, after a ſmall ſemicircular deſcent, it meets with the pancreatic juice and bile; both which joining with it, renders ſome part of the aliment more fluid, by ſtill diſuniting the groſſer parts from the more pure, and here the chilification is made perfect. The bile which abounds with lixivial ſalts, and is apt to entangle with the groſſer parts of the concocted aliment, ſtimulates the guts, and cleanſes their cavities of the mucous matter ſeparated from the blood by the glands of the guts, and lodged in their cavities; which not only moiſtens the inſide of the guts, but defends the mouth of the lacteal veſſels from being injured by any thing which paſſes that way. The contents of the inteſtines move ſtill on, by means of the periſtaltic motion of the guts, whilſt thoſe thinner parts, fitted to the pores of the lacteal veſſels are abſorbed by them: the thicker move ſtill more ſlowly on, and by the many ſtops they continually meet with by the connivent valves, all the chyle or thin parts are at length entirely abſorbed; the remains being merely excrementitious, are only fit to be protruded by ſtool. In the paſſage through the ſmall inteſtines, the finer part of the maſs, which we call the chyle (as has been already obſerved) enters the orifices of the lacteal veſſels of the firſt kind, wherewith the whole meſentery abounds, which either alone, or together with the meſeraic veins, diſcharge themſelves into the glands, at the baſis of the meſentery. Then the chyle is taken up by the lacteals of the ſecond kind, and is conveyed into glands between the two tendons of the diaphragm, called Pecquet's reſervatory, or receptaculum chyli; whence it is carried to the heart by the thoracic duct, and the ſubclavian vein; here it firſt mixes with the blood, and in time becomes aſſimilated thereto.

SECT. VIII.

Of the Blood and its Circulation.

Of the blood.

THE blood is the great ſource from which all the other liquors of the body are derived. It is formed from chyle by various and ſucceſſive degrees. A few hours after meals, the chyle is found conveyed into the blood, though not aſſimilated. Hence, when after a liberal meal, blood is taken from a vein, beſides the ſerum and the red part, there is a white, ſweet, and chylous part found fluctuating in it. In a few hours the chyle, conveyed with the blood through the veſſels, is ſeparated from it by the fabric of the breaſts, and affords milk, which is of a different nature both from blood and chyle; for in milk there begins to be formed that tendency to concretion which is already preſent in the ſerum of the blood, for it yields cheeſe. But this tendency to concretion is never found in the chyle. Hence we may artificially imitate the preparation of chyle in emulſions, but never the nature of milk. When a ſound woman for twelve hours totally abſtains from meat and drink, her milk begins to be ſaline and yellowiſh. If ſhe abſtains ſtill longer, nothing is found in the blood taken from her veins, but what, like the white of an egg, is by means of the fire concreted, which never happens in the chyle. Hence we may conclude, that the bodies of ſound perſons are the formers and producers of their own blood, in the ſame manner as any plant, by its peculiar fabric, prepares its ſap from the juices of the fertile earth and the genial influences of the circumambient air. But in the human body the formation of the blood depends principally upon the efficacy of the circulation, by which the veſſels act upon their contained fluids: hence in the moſt robuſt perſons the blood is reddeſt, or rather almoſt black, in conſequence of its ſaturated red colour, and is concreted almoſt the very moment it is left in a ſtate of reſt.

In acute diſeaſes, when the circulation is increaſed, all the parts are intenſely red, and the ſerum of the blood is converted into a ſciſſile maſs. But in weak perſons in whom the efficacy of the circulation is far leſs, all the parts are pale and languid, whilſt the blood is thin and hardly capable of concretion. But when in ſuch perſons, with due exerciſe and proper remedies, the circulation is augmented, the red colour and due coheſion of the blood return.

Analyſis of the blood. The moſt obvious compoſition of blood is of a thin, watery liquor, called ſerum; and a thick reddiſh part, called craſſamentum. This laſt, viewed by the microſcope, is ſeen to conſiſt of red globules, of a certain determined magnitude, the ſame in different parts of the whole body. Lewenhoek went farther; he diſcovered thoſe globules to be made up of leſſer ones, which were likewiſe compoſed of others ſtill ſmaller; and ſo on to the fifth, ſixth, &c. orders. Hence it appears, how little reaſon certain phyſiologiſts had to ſuppoſe theſe globules made up of viſcid bullulæ, incloſing little ſpherules of air. As to the fibres, which many have deſcribed as eſſential parts of the blood, there are no veſtiges of them to be found, at leaſt in its natural ſtate.

Serum is a thin, tranſparent, ſaltiſh liquor, which makes a conſiderable part in the maſs of blood. The ſerum is in reality the ſame with the lympha, which is carried by the arteries through the ſeveral parts of the body; whence it returns partly in the veins, and partly in the lymphatic veſſels. Sweat and urine are nothing but ſerum drained off their nutritious parts, by repeated circulations, and ſecreted from the blood in the glands of the ſkin and kidneys. The ancients did not pretend to determine the proportions of the conſtituent parts of the blood; but from the experiments of modern chemiſts, they have been found to be nearly as in the following table, where the blood it reckoned unity, and ſuppoſed to conſiſt of 4873 grains.

	N°. of grains.	Proportion to the whole.
Water	4068	$\frac{5}{6}$
Oil	333	$\frac{1}{15}$
Salt	190	$\frac{1}{25}$
Earth	65	$\frac{1}{75}$
Air	171	$\frac{1}{28}$

Thus we ſee how greatly the watery or phlegmatic part of the blood exceeds the other principles. However, it is proper to obſerve, that there is a remarkable difference between the blood as it circulates in the veſſels of animals, and when expoſed to the cold air. We know that all bodies whatſoever are condenſed by cold, and expanded again by heat; ſo that we may ſafely affirm cold blood, or blood in that ſtate in which it is commonly examined, to be ſpecifically heavier than that circulating in veſſels of living animals. For the quantity and velocity of the blood, ſee Chap. i Sect. 5.

Circulation of the blood

The circulation of the blood is that natural motion whereby it is alternately carried from the heart to all parts of the body by the arteries, and returned from the ſame parts to the heart by the veins. This motion is chiefly cauſed by the dilatation and contraction of the heart, and is the principle on which life depends. All the veins diſcharge themſelves into the ventricles of the heart; from hence all the arteries ariſe; the blood expelled out of the right ventricle, muſt be carried through the pulmonary artery into the lungs; from which it muſt be returned by the pulmonary veins, to the left ventricle: from the left ventricle, the blood, thus imported, is, by the conſtriction of that part, again expelled into the aorta, and by it diſtributed all over the reſt of the body, and thence is returned again to the right ventricle by the cava, which completes the circulation. This circulation becomes actually viſible, with the aſſiſtance of a microſcope, eſpecially in fiſh, frogs, &c. wherein the inoſculation, or union of the extremities of the arteries with thoſe of the veins, together with the globules of the blood flowing from the one into the other, may be plainly ſeen, as repreſented in Cheſelden's Anatomy. Hence it is evident, the blood is carried by the vena cava into the right auricle, and from thence into the right ventricle. From the right ventricle it is ſent into the lungs through the pulmonary artery, and by the pulmonary vein returned to the left auricle, from that into the left ventricle; out of which it is propelled through the aorta, and by its minute ramifications, diſtributed all over the body; then being taken up by the beginnings of the veins, it is again brought to the right ſinus (of the aſcending and deſcending cava) and auricle; and this circulation is inceſſantly reiterated. For a more particular and finiſhed account of the circulation of the blood, the reader is referred to Boerhaave, Haller, Whytt, &c. who have wrote profeſſedly on the ſubject. However, it may not be be amiſs to obſerve the following phænomena, with which the circulation is attended.

1. Both the venous ſinuſes of the cava are filled and grow turgid at the ſame time. 2. Both auricles grow flaccid at the ſame time, and both are filled at the ſame time with blood, impelled by the contractile force of its correſpondent muſcular venous ſinus. 3. Each ventricle contracts and empties itſelf of blood

at the ſame time; and the two great arteries are filled and dilated at the ſame time. 4. As ſoon as the blood, by this contraction, is expelled, both ventricles being empty, the heart grows larger and broader. 5. Upon which the muſcular fibres of both venous ſinuſes contract, and expreſs the blood contained in them, into the ventricle of the heart. 6 In the mean time, the venous ſinuſes are again filled as before, and the auricles, &c. return into their former habitude. 7 This alteration continues till we begin to languiſh under the approach of death, at which time the auricles and venous ſinuſes make ſeveral palpitations, for one contraction of the ventricle.

In a fœtus, the apparatus for the circulation of the blood is ſomewhat different from that in adults, as above deſcribed. The ſeptum, which ſeparates the two auricles of the heart, is pierced through with an aperture called the foramen ovale; and the trunk of the pulmonary artery, a little after it has left the heart, ſends out a tube into the deſcending aorta, called the communicating canal. The fœtus being born, the foramen ovale cloſes by degrees, and the canal of communication dries up, and becomes a ſimple ligament.

SECT IX.

Of Muscular Motion.

Of muſcular motion.

A Muſcle is the immediate organical efficient cauſe or inſtrument of animal motion, whether voluntary or involuntary. I have ſaid organical, becauſe there are motions producd in the living body by mere elaſticity; an inſtance of which we have ſeen in the cartilages of the ribs, and in the arteries. The general characteriſtic of all muſcles is, that they conſiſt of fleſhy fibres, which, when acting, ſhorten and contract themſelves. For the deſcription of a muſcle, See Chap. i. Sect. 4. Muſcles are alſo plentifully ſupplied with arteries, carrying red blood, which branch out into ſmaller and ſmaller twigs, till they ſeem loſt, both in the cellular membrane, and the proper ſubſtance of the muſcle. Theſe arteries are accompanied with veins ramified in like manner, inſomuch, that a conſiderable part of the bulk of a muſcle is owing to its blood-veſſels; and the red colour of the fibres ſeems to be produced by the blood which irrigates them; for when that is waſhed out by repeated injections of warm water, the muſcle becomes both pale and ſhrivelled. Lymphatic veins are likewiſe obſerved in muſcles: and, laſtly, nerves are diſtributed to muſcles in plenty, and ſoon become ſo ſmall by their diviſions, as to be paſt tracing. Blood-veſſels and nerves are not wanting even in the tendons; but are there both ſmaller and leſs numerous. See every thing relating to muſcles in general, moſt accurately, fully, and elegantly deſcribed, as far as the eye, injections, knife, or microſcope can go, in the firſt book of Albinus's Myology.

No one action in the animal body hath ſo much puzzled enquirers, as the particular manner in which muſcular motion is performed: and no wonder, ſince anatomy ſerves us in little or no ſtead in our reſearches after it: we can neither reach the laſt diviſions and terminations of the blood-veſſels and nerves, nor can we any how come at the ultimate ſtructure of a muſcular fibre. When we have uſed the greateſt magnifiers to diſcover the texture thereof, we are no wiſer than when we only employ the naked eye; we ſee nothing but ſmaller bundles ſimilar to the larger ones, which they compoſe. As therefore the truth cannot be made out by direct autopſia, authors have had recourſe to fancy and conjecture; and, as it is much eaſier to demoliſh than to build up, to confute error than to find out truth, each writer on this ſubject, after confuting former hypotheſes, which for the moſt part it was not difficult to do, thought it incumbent on him to propoſe a new one of his own, which was in its turn confuted. I ſhall, therefore, with ſome little variation, follow Boerhaave and Haller, and inſert what ſeems to be moſt probable concerning this abſtruſe matter. It is certain, as hath been mentioned before in Chap. i. Sect. 7. that tying a nerve faſt round, cutting, or otherwiſe deſtroying it, immediately ſtops the voluntary action of any muſcle, that is ſupplied ſolely with filaments from that nerve. Tying an arterial trunk, which furniſhes a muſcle with all its blood, deſtroys its action alſo; but not inſtantly, nor till ſome conſiderable time after; at leaſt ſeveral hours. From this it may be juſtly concluded, that an actual preſent ſupply of arterial blood to the ſubſtance of a muſcle, is not requiſite to every ſingle exertion of its contractile power. And it is natural to think that an inability of moving, after the artery hath been tied a conſiderable time, is occaſioned by the muſcle's being thereby reduced to a ſtate of mortification for want of nouriſhment, and ſo rendered unfit for obeying the influence of the nerve, whatever that may be. Every hypotheſis, therefore, which ſuppoſes a mixture of blood with the nervous fluid in the organiſm of the muſcle, to produce every ſingle act of muſcular motion, muſt fall to the ground. The belly of a muſcle, (for ſo its fleſhy part is called) when the muſcle is acting, ſwells and becomes hard, as any one may perceive in his own body, (by putting his hand upon the maſſeter muſcle for example, while the jaws are forcibly pulled together; or upon the biceps muſcle, while the fore-arm is forcibly bent.) This, one would imagine, denotes that there then is an additional influx of ſubſtance into the fleſhy fibres. And as deſtroying or tying a nerve immebiately ſtops the action of the muſcle which is ſolely ſupplied with filaments from that nerve, it appears natural to infer, that the additional ſubſtance flows through the nerve into the organiſm of the muſcle; and that this additional ſubſtance is no other than the liquid of the encephalon, the nervous fluid or animal ſpirits, the exiſtence of which, I think, is almoſt beyond a doubt, ſee Chap. i. Sect. 7. All muſcles are plentifully ſupplied with nerves, which are diſtributed by minute ramifications through their whole ſubſtance, till they are paſt tracing. A muſcle, while it is acting, ſwells and grows harder in its fleſhy fibres, and therefore probably receives an addition to its ſubſtance. The nerve that ſolely ſupplies that muſcle, being tied or deſtroyed, its action is immediately ſtopt; whereas, if the artery, that ſolely furniſhes it with blood-veſſels, is compreſſed or cut, the action of the muſcle continues for hours after. This is a fair ſorites, as logicians ſpeak, the natural concluſion of which appears to be, that an influx of the nervous juice or animal ſpirits is the immediate cauſe of the ſwelling and hardneſs in the belly of the muſcle; by which it is ſhortened, and its ends, if they are moveable, brought towards one another. The experiments of Bellini, profeſſor Monro, Dr. Stewart and others, mightily illuſtrate and confirm this doctrine.

SECT. X.

Of the Pulse.

Of the pulſe THE pulſe denotes the beating or throbbing of the heart and arteries. No doctrine has been involved in more difficulties than that of pulſes; ſince in giving a phyſiological account of them, phyſicians have eſpouſed quite oppoſite ſentiments; ſome queſtioning whether the pulſe is owing to the ſyſtole or diaſtole; as alſo, whether the motion of the heart and arteries is one and the ſame for a moment of time. With regard to motion, the pulſes are reckoned only four, great and little, quick and ſlow. When quickneſs and greatneſs are joined together it becomes violent; and when it is little and ſlow, it is called a weak pulſe. They are alſo ſaid to be frequent and rare, equal and unequal; but theſe are not the eſſential affections of motion. Frequency and quickneſs are often confounded with each other. The pulſe is great when every artery beats hard, both in length, breadth, and depth; the pulſe is ſtrong, in which the artery ſtrongly ſtrikes, the finger feeling it; the pulſe is equal in which every pulſe ſtrikes the finger equally; and the pulſe is quick, that beats oftener than uſual in the ſame ſpace of time.

From contrary cauſes proceed contrary pulſes: ſuch are, the ſmall, the weak, the unequal, and the ſlow pulſe. A pulſe is ſaid to be hard or ſoft, with regard to the artery, according as that is tenſe, renitent, and hard; or flaccid, ſoft, and lax. The diſpoſition of the arteries contribute greatly to the change of the pulſe; wherefore it ſometimes happens, that the pulſe in both arms is not alike, which is very common in a hemiplegy. Add to theſe a convulſive pulſe, which does not proceed from the blood, but from the ſtate of the artery, and is known by a tremulous ſubſultory motion; the artery ſeems here to be drawn upwards. This in acute fevers is the ſign of death; and is ſaid to be the pulſe in dying perſons, which is likewiſe generally unequal and intermitting. A great pulſe ſhews a more copious afflux of the blood to the heart, and from thence into the arteries; a little pulſe the contrary. The pulſes of perſons differ according to the largeneſs of the heart and veſſels, the quantity and temperies of the blood, the elaſtic force of the canals; as alſo with regard to the ſex, age, ſeaſon, air, motion, food, ſleep, watchings, and paſſions of the mind. The pulſe is larger and more quick in men than in women; in the bilious, and ſanguineo-bilious, than in the phlegmatic and melancholic.

lancholic. Thoſe who are lean, with tenſe fibres, and larger veſſels, have a greater and a ſtronger pulſe, than thoſe that are fat, with lax fibres and ſmall veſſels; whence they are more healthy, robuſt, and fit for labour. In children, the pulſe is quick and ſoft; in adults, greater and more violent; in the old, it is commonly great, hard, and ſlow. Labour, motion, and exerciſe of the body increaſe the circulation of the blood, the excretions, and particularly reſpiration; reſt renders the circulation ſlow and weak; intenſe ſpeaking increaſes the circulation, and conſequently renders the pulſe large and quick. In watching, the pulſe is more evident; in ſleep, more ſlow and languid. After drinking hot things, ſuch as coffee and tea, or hot-bath-waters, as well as after meals, the pulſe vibrates more quick. But nothing produces a greater change in the pulſe than affections of the mind; therefore the phyſician would do wrong to feel the pulſe immediately upon the ſight of a ſick perſon, as the great ſolicitude of the patient, how he may appear to the phyſician, often changes the pulſe. In terror, it is unequal, ſmall, and contracted; in joy, frequent and great; in anger, quick and hard; in ſadneſs, ſlow, ſmall, deep, and weak; and in intenſe ſtudy, languid and weak. With regard to the air, when after the predominancy of a weſt, or ſouth wind, it becomes north, or eaſt, the pulſe is ſtronger and larger; as alſo when the quickſilver riſes in the barometer. But when the atmoſphere is denſe, humid, and rainy, with a long ſouth wind, as alſo where the life is ſedentary, the ſleep long, and the ſeaſon autumnal, the pulſe is languid and ſmall, and the perſpiration decreaſed. In May it is great, and ſometimes violent; in the middle of ſummer, quick, but weak; in the autumn, ſoft, ſlow, and weak; in the winter, hard and great.

A draſtic purge and an emetic, render the pulſe hard, quick, and weak, with loſs of ſtrength; chalybeates, and the bark, render it great and ſtrong, and the complexion lively; volatiles amplify, and increaſe the pulſe; acids and nitrous remedies refrigerate the body, and appeaſe the pulſe; opiates, and the like, render it ſmall and weak, and diminiſh the elaſticity of the ſolids; whereas, things abounding with a friendly ſulphur increaſe the pulſe; but poiſons render it ſmall, contracted, and hard. When the quantity of blood is too great, bleeding raiſes the pulſe. The ſeveral indications of the pulſe in different diſorders, may be ſeen under the reſpective names of theſe diſeaſes in my Marine Surgeon, &c. to which the reader is referred.

SECT. II.

Of Respiration.

Of Reſpiration.

RESpiration is the act of reſpiring or breathing the air; being the alternate drawing in and expelling air into and out of the lungs, whereby their cavity and volume, and that of the thorax or cheſt, in which they are placed, is alternately enlarged and diminiſhed. What reſpiration is, and why it is uninterruptedly carried on without the concurrence of the mind, will appear from the following conſiderations of Boerhaave. The lungs ſuſpended in the air, which every where acts upon them, and preſſes them equally, collapſe, and become much leſs than when they remained in the intire thorax. This is principally performed by the contractile force of the muſcular fibres, which connect the ſquamous ſegments of the bronchia. If the lungs, when contracted, be filled with air, forcibly blown through the glottis, they are ſo diſtended as in bulk not only to equal that which they had to the intire thorax, but even to exceed it; all which is ſufficiciently certain from experiments. The ſame thing happens, when acceſs for the air thro' the glottis is left to the lungs, the air externally acting on the lungs is either removed, or its preſſure diminiſhed. Hence, it is obvious, that the lungs, by their proper force, have always a tendency to become leſs in all their parts than they are when placed in the intire thorax. For this reaſon it is certain, that they are in a continual ſtate of diſtraction ſo long as a perſon is alive, ſo that they muſt collapſe, and be diminiſhed, whilſt the animal remains in a vacuum, obtained by an exhauſting the air in an air-pump. For there is nothing ſimilar to the circumambient air between the external membrane of the lungs, and all the internal ſurface of the pleura in a ſound perſon; nothing, therefore, externally compreſſes the lungs, except the diaphragm. There is, however, always an internal air contained in them, and freely conveyed to them through the glottis. Hence the lungs are always ſomewhat more diſtended by the internal, than they are compreſſed by the external air, the acceſs of which is hindered by the diaphragm, which is ſo connected with the ribs and vertebræ, that the air cannot enter the thorax in ſuch a manner as would be requiſite for an equilibrium. Since, therefore, in inſpiration, a greater quantity of air enters the lungs through the glottis, it will extend the lungs more, and overcome their natural force, ſo that in this action the lungs are paſſive; but how far they are active, is only to be diſcovered from certain phænomena. In vital inſpiration, then, eſpecially conſidered in a ſleeping perſon, firſt the ribs, particularly the nine ſuperior, articulated at the vertebræ, and by cartilages joined to the ſternum, with their arched part, riſe to the clavicles, ſo that this motion is principally obſerved in the middle of the arch, whilſt three, or perhaps four, inferior ribs are turned downwards, backwards, and obliquely outwards, but in ſuch a manner that the ſeventh, eighth, ninth and tenth ribs are, by their cartilaginous ſegments, as it were drawn inwards. Secondly, the whole abdomen, to the very end of inſpiration, is gradually rendered more tumid and preſſed downwards. Thirdly, at the ſame time the cavity of the thorax is enlarged, as is obvious from repeated experiments. Whilſt the parts remain in this ſituation, the air acts upon the lungs with a force equal to that with which the thorax reſiſts, ſo that the lungs will remain in a ſtate of reſt. Hence leſs blood will paſs through them, and a ſmaller quantity of it will be forced into the left ventricle of the heart, and conſequently leſs blood will be conveyed to the cerebellum and its nerves. The arterial blood will alſo act leſs upon the intercoſtal muſcles and diaphragm, ſo that the cauſes dilating the thorax are weakened. Hence the elaſticity of the cartilaginous ſegments again depreſſes the ribs, in which work they are alſo aſſiſted by the muſcular fibres ariſing from the ſide of the ſternum within the thorax, and inſerted into the bony extremities, and cartilages of the true ribs. At the ſame time the diſtracted fibres of the peritonæum and abdominal muſcles reſtore themſelves. Hence the compreſſed viſcera thruſt the relaxed diaphragm upwards into the thorax, which is by this means contracted, and the air expelled from the lungs. By this means expiration and the action already mentioned, are performed. But in a particular manner by theſe two actions the blood is not only carried through the lungs, but its motion accelerated. Phyſicians are not agreed about the uſe and effects of reſpiration; ſome think that the air is inſinuated into the veſſels of the lungs, to give a greater fluidity and motion to the blood; others, that it conveys very ſubtile nitrous corpuſcles thereunto, which gives it the red colour; others again believe the air ſerves to condenſe the blood, which has been heated by circulation. It is certain, that the air entering into the lungs, and all the ſmall ramifications which ſurround its veſicles, is broke, comminuted, and rendered more fluid, and that the blood is deprived of a ſeroſity, which proceeds from the lungs by perſpiration in the form of a vapour that is viſible in cold weather. It may be added, that the voice, laughter, coughing, ſneezing, yawning, and ſucking, depend upon reſpiration.

Boerhaave takes the principal uſes of reſpiration to be the further preparation of the chyle, its more accurate mixture with the blood, and its converſion into a nutritious juice, proper to repair the decays of the body. other authors imagine a great uſe of reſpiration to be, by the neighbourhood of the cold nitrous air, to cool the blood coming reeking hot out of the right ventricle of the heart through the lungs, and to act as a refrigeratory; others aſſert one grand uſe of reſpiration to be the throwing off the fuliginous vapours of the blood, along with the expelled air; and for inſpiration, they maintain, that it conveys a nitro-aerial ferment to the blood, to which the animal ſpirits, and all muſcular motion are owing. But Dr. Thruſton rejects all theſe as the principal uſes of reſpiration; and from the experiments of Dr. Croon, Dr. Hook, and others, made before the Royal Society, he ſhews the principal uſe of reſpiration to be that of moving, or paſſing the blood from the right to the left ventricle of the heart, and ſo to effect the circulation; whence it is, that perſons hanged, drowned, or ſtrangled, ſo ſuddenly die, viz. becauſe the circulation of the blood is ſtopped, and for the ſame reaſon it is, that animals die ſo ſpeedily in the air-pump. This uſe of reſpiration Dr. Drake not only confirms, but carries farther, making it the true cauſe of the diaſtole of the heart, which neither Borelli, Dr. Lower, nor Mr. Cowper, had well accounted for, but

this,

this, as before obſerved, is contrary to experience. From experiments made upon dogs, and other animals, Dr. Hales ſhews, that without reſpiration the blood would ſoon turn putrid and peſtilential; and indeed the only animal exempted from the neceſſity of reſpiration is a fœtus. From the violent and fatal effects of very noxious vapours on the reſpiration and life of animals, the doctor ſhews how the reſpiration is proportionably incommoded when the air is loaded with leſſer degrees of vapour, which vapours do in ſome meaſure clog and diminiſh the air's elaſticity, which it beſt regains by having theſe vapours diſpelled by the ventilating motion of the free open air, that is rendered wholeſome by the agitation of winds; thus what we call a cloſe warm air, ſuch as have been long confined in a room, without having the vapours in it carried off by communicating with the open air, is apt to give us more or leſs uneaſineſs in proportion to the quantity of vapours which are floating in it. Hence, the great uſe of ventilators, and air ſails on ſhip-board. And thus many of thoſe who have weak lungs, but can breathe very well in the freſh country air, are greatly incommoded in their breathing, when they come into large cities where the air is full of fuliginous vapours; and even the moſt robuſt and healthy, in changing from a city to a country air, find an exhilerating pleaſure ariſing from a more free and kindly inſpiration, whereby the lungs being leſs loaded with condenſing air and vapours, and thereby the veſicles more dilated with a clearer and more elaſtic air, a freer courſe is thereby given to the blood, and probably a purer air mixed with it. For a full account of reſpiration, beſides Boerhaave and Haller's Phyſiology, ſee Monro's Oſteology; Whytt's Eſſay on Vital and other Involuntary Motions; and likewiſe a Treatiſe de Reſpiratione amongſt the Opuſcula Anatomica of Haller; in which there are many experiments on live animals.

SECT. XII.

Of Perspiration.

Of perſpiration.

PErſpiration is the evacuation of the juices of the body through the pores of the ſkin; and is diſtinguiſhed into ſenſible and inſenſible; ſenſible perſpiration is the ſame with ſweating, and inſenſible perſpiration, that which eſcapes the notice of the ſenſes; and this laſt is the idea affixed to the word perſpiration when uſed alone.

Inſenſible perſpiration

The veſſels through which perſpiration is performed, lie obliquely under the ſcales of the ſcarf ſkin, and are ſo inconceivably ſmall, that from a calculation made by Lewenhoeck, it appears, that the mouths of an hundred and twenty-five thouſand of them may be covered with a common grain of ſand. The matter of inſenſible perſpiration is a fine ſubtile fluid which exhales from the body in the form of a vapour, and proceeds from the whole ſurface and from every cavity. It is of an aqueous and ſaline nature, and ſeems to have a great analogy with urine; becauſe in a healthy ſtate, the increaſe of the one, diminiſhes the other. Many experiments prove its exiſtence. If you paſs your finger over the ſurface of a looking-glaſs, or any other poliſhed body, it will leave a track of moiſture. If you put your naked head near a white wall, expoſed to the ſun, the ſhadow of the vapours which proceed from the pores of the ſkin, may be plainly ſeen: or if you breathe upon glaſs you may perceive it covered with ſmall drops of water; and the vapours which proceed from the lungs, are in winter condenſed by the cold, and form a kind of bluiſh miſt, proceeding from the mouth. Other experiments ſhew that the matter evacuated this way, is, at leaſt in ſome countries, more than equal to all the other evacuations by ſtool, urine, &c. Sanctorius found in Italy, under the circumſtances of a moderate diet, middle age, and eaſy life, that the matter inſenſibly perſpired was five-eights of that taken in for food; ſo that there only remained three-eighths for nutrition, and for the excrements of the noſe, ears, inteſtines, bladder, &c. The ſame author ſhews, that as much is evacuated by perſpiration in one day, as by ſtool in fourteen days. But Dr. Bryan Robinſon, of Dublin, has found the caſe very different, both in England and Ireland, and even in South Carolina, in all which places he found that the quantity of urine exceeds that of perſpiration; and that if the meat and drink of one day be four pounds and a half, the perſpiration of that day will be two pounds, the urine two pounds five ounces, and the ſtool three ounces. But it is neceſſary to obſerve, here is no account made for inhalation or reſorption; which if not conſidered, it is plain, that only the apparent, not the real quantity of perſpiration can be found by ſtatical experiments, as were Sanctorius's and Dr. Robinſon's above-mentioned.

Sweat. Sweat may be reckoned, and termed, ſenſible perſpiration. It comes from the ſame emiſſaries with perſpiration, there being no good reaſon to think the outlets of theſe two diſcharges to be different. Sweat is produced when the ſmall exhaling arteries, which naturally carry off the matter of inſenſible perſpiration, are ſo dilated, as to admit a ſenſible fluid. Sweating, except when it is excited by labour and exerciſe, is always morbid, and does either harm or good, only by accident, according to the ſtate the body is in. It is a frequent way that nature takes to throw off the morbific matter in fevers, and then it is beneficial. But it frequently proves detrimental, by diminiſhing the quantity of the fluids, waſting the ſpirits, and drying the remaining juices, by carrying off their moſt fluid parts.

Uſe of perſpiration. The uſe of inſenſible perſpiration ſeems to be, firſt, to give vent to the oily and ſaline parts of the blood and humors; which, after having undergone the effects of repeated circulation, if retained, would in time become too acrimonious, volatile, and exalted, to be conſiſtent with that mild balſamic nature in the juices, which is neceſſary to keep up health and life. And ſecondly, as theſe are expelled, intimately mixed with and diſſolved in an aqueous vehicle, highly attenuated, and in the form of a vapour, the ſteam, while it paſſes, muſt of courſe moiſten and lubricate the corpus reticulare and epidermis; and likewiſe the nervous papillæ, preſerving the latter in a proper ſtate for ſenſation. It may be promoted by exerciſe, by dry frictions with a coarſe linen cloth or a fleſh-bruſh, by warm baths, and waſhing the hands, feet, head, &c.

Abſorption. Inhalation or abſorption, is a drawing of fluid ſubſtances into the body from without, through the pores of its ſurface. The reality of this is made evident by a variety of obſervations and experiments. Many medicines applied to the ſkin, produce the ſame effects as if they were taken inwardly; as mercury, cantharides, aloes, &c. By ſtatic experiments, bodies have been found heavier in the morning than they were the night before, without eating or drinking. Dr. Keil mentions one inſtance, in which full eighteen ounces were gained; and in ſome caſes of dropſy, urine hath been made in large quantities under the moſt rigid abſtinence from drink, without a detumeſcence of the abdomen; which could not have happened without the abſorption of humidity from the ambient atmoſphere. As the channel of perſpiration and ſweat is in the ſmalleſt extremities of the cutaneous arteries, opening into the air on the ſurface of the body, that of abſorption muſt be in ſmall venous tubules, which, with patent orifices on the epidermis, ſuck up humidity from the air, as capillary tubes attract fluids, and, from ſmaller canals, carry them into larger venous branches, and ſo into the great road of circulation. As perſpiration rids the body of ſuch fluids as are either ſuperfluous in quantity, or might prove noxious in quality, if retained, abſorption on the other hand, ſupplies it with humidity when wanted; and accordingly, it is greateſt when the veſſels are moſt empty, from whatever cauſe their emptineſs proceeds. It is likewiſe largeſt when the atmoſphere is moſt charged with aqueous contents; and therefore, cæteris paribus, is more copious in the night than in the day-time. But they concur in the other uſe, viz. that of moiſtening the epidermis and nervous papillæ. We may conclude from what has been ſaid concerning abſorption, that nutritive baths may be of great uſe, where a ſufficient quantity of food for the preſervation of life, cannot be taken in by the mouth, and digeſted in the ſtomach and inteſtines. This I think equal, if not ſuperior to nutritive glyſters.

SECT. XIII.

Of SECRETION.

SEcretion is the ſeparation of ſome fluid from the blood with which it is mixed. In the human body a great variety of different juices is required to anſwer a like variety of purpoſes; all which are furniſhed out of the ſame general maſs. Thus, out of the blood are formed all the other juices of the body; viz. lymph, ſaliva, ſtomach-liquor, inteſtinal juices, pancreatic juice, bile, urine, &c. The manner wherein this ſecretion is performed, has been greatly enquired into for a century paſt; but as the exceeding minuteneſs of the organs whereby ſecretion is effected, prevents any certain diſcovery, various authors have imagined various me- Of ſecretion thods for explaining it. Naturaliſts have recourſe to what is called imbibition, which I think moſt reaſonable to ſuppoſe. Theſe maintain that, beſides the different diameters of the pores, it is required that the ſeveral parts be already imbued or moiſtened with a liquor like to that they are to filtre.

This opinion Winſlow adopted; and not ſatisfied with conjectural principles, applied himſelf to experiments, in order to inveſtigate the manner wherein ſecretion is performed, and lays it down thus:

It is well known that a piece of brown paper, which is only an aſſemblage of ſmall fibres compacted cloſe to each other, having once imbibed oil or water, will never let any other liquor paſs through it but of the ſame kind with what it is impregnated with; all others it ſtops. Now in the ſecretory ducts of all the glands we find a parallel ſtructure, an aſſemblage of fine threads or filaments bound cloſe together, much as in brown paper, &c. only differently diſpoſed; this plexus then having once imbibed a certain juice, will not let paſs any of the liquors which arrive at the orifices of theſe ducts, but that which it had firſt imbibed: the cauſe of this phænomenon is referred to the attraction of coheſion, which is found ſtronger between the homogeneous than the heterogeneous parts of the ſame fluid. As the blood then is not an homogeneous liquor, but a compound of an infinity of different parts or molecules, ſome oily, others mucilaginous, aqueous, ſaline, ſubtile, groſs, &c. In its motion along the arteries of the gland, it becomes divided into all the little ramifications thereof, by which means its velocity is exceedingly abated, and the molecules are obliged to go off, one by one, through the narrow paſſage of the artery into the vein, and of conſequence to paſs over the orifice of the ſecretory ducts of the glands, which is already tinged with a juice of a certain nature. Such of the molecules therefore, as are found of the ſame nature with the juice they meet withal at the entrance of the ſecretory duct, join themſelves to them, and entering the ducts, are driven on by others that follow them, and are at length diſcharged into the excretory duct. But how theſe parts ſhould have firſt imbibed the particular juices neceſſary for their reſpective ſecretions, is the queſtion. Mr. Winſlow thinks it probable that they had been imbued with the juices they were to filtrate at the firſt formation of the body, or at the time when the ſolid parts were framed. Keil accounts for ſecretion from the joint conſideration of the different diameters of the veſſels, the different velocity of the blood, the different angles the ducts make with the arteries, and the different attraction of the various parts under all theſe different circumſtances. It is obſerved that in this theory there is ſomething arbitrary and conjectural; beſides, that the reaſoning is carried on to ſuch a length, that in a thing, the principles whereof are ſo obſcure, the parts or organs ſo imperfectly known, and the whole proceſs carried on out of ſight, the mind cannot ſafely acquieſce in it. Hales makes it evident from experiments that the animal ſecretions are not made with the full force of the arterial blood, but more gradually and ſparingly, ſo as to be carried forward in thoſe very fine veſſels by an alternate pulſive force of the arterial fluid, and attractive power of the fine ſecerning veſſels, aſſiſted alſo by conſtant vibrations; for the animal fluids and ſolids are in an inceſſant, vibrating ſtate. In this manner, doubtleſs, the plentiful ſecretions are made into the ſtomach and guts, as alſo in the pancreas, meſenteric, ſalival, and other glands of the body; and thus alſo the perſpiring matter is carried off, not by the more protruſive force of the arterial blood alone, but alſo by the warmth and mutual action of the fluids and ſolids. This may ſerve at preſent for a compendious view of the general doctrine of ſecretion; having already exceeded the bounds I at firſt preſcribed for this treatiſe.

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FINIS.